Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LIII. NEW YORK, THURSDAY, MARCH 4, 1909. No. 10.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada..... " " 4.50
Other Foreign Countries within the Postal Union..... " " 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

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Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1908 was 898,000. Of this issue 25,000 copies are printed.

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THE EVOLUTION OF METROPOLITAN SERVICE.

Waterside Station No. 2 of the New York Edison Company is a very striking example of the way in which an electrical supply company needs the services of both prophet and engineer in meeting its needs. The rate of growth of load in a modern city is something that almost passes belief. In New York, as in every other metropolis, all principles of normal growth of activity and population are violated. A city nowadays does not grow like a plant, but like a magnet in a shower of iron filings. Hence, the eternal difficulty with rapid transit and other public services. It would be almost impossible to build another subway in New York so rapidly that it would not be foredoomed to overcrowding from the moment its stations should open their doors. Such, too, has been the tendency in electrical supply, and Waterside Station No. 2, huge as it is, will probably require help long before it now seems probable. When Waterside No. 1 was built there was a question as between reciprocating engines and turbines in its equipment. In the short time that has elapsed between that date and the present, that equipment matter has resolved itself into a choice between turbines, and even that doubt seems to be passing at the present time. The big turbine certainly has made good in central-station practice, and the economical results obtained from the big modern units are so excellent as to have little to be desired so far as the generation of alternating current is concerned. And within the past few years a vast proportion of all the generating plants built have been for alternating current irrespective of the final disposition of the output. Whether alternating distribution is rapidly to displace the older direct-current distribution is another matter. As the exigencies of service force the alternating-current wires underground, it will doubtless be discovered that alternating-current distribution is not such a bad thing as it was the fashion in some circles to believe it 15 years ago.

Not the least interesting part of Waterside Station No. 2 is the coal-handling and boiler plant. Here, too, is strong evidence of the evolutionary process, for part of the boilers are fired by hand and part equipped with automatic stokers. This is at least evidence that the stoking question is still unsettled, at least for the grades of coal used in New York. There is, too, evidence of a strong tendency to increase the size of the boiler units, although at present one must own that the generators have more than kept ahead of the game. There seems to be no good reason why automatically stoked boilers cannot be designed for double the outputs now usual, with gain in simplicity and cost. The tendency is toward increase of size, although as yet no very radical steps have been taken. Another tendency not yet very marked is toward the use of greater furnace space with a corresponding gain in cleanliness of combustion. We noted some time since a remarkable piece of research done at the University of Illinois on smokeless combus-

tion, a research that has already borne fruit in at least one great Western station. The Waterside stations are equipped with very complete coal-handling systems that should make it economically possible to use almost any grade of coal that is suited to the needs of the fire room. The greater attention recently given to boiler and furnace design is one of the things that bears very hopefully on costs of production. If one compares in any large station the known efficiency of the generating sets with the hole in the coal pile, it becomes evident that the generator room is a long way ahead of the fire room. Here is the chance for modern design and improvements in economy, and stations such as that here considered are moving along toward better conditions. Superheat and high vacuum have forced their way into practice along with the turbine, and attention must now be concentrated on the preliminary stages of the cycle that ends on the distributing system.

One of the very pleasant things about these new stations is the attention paid to finish. A modern plant is beautifully clean and bears everywhere the marks of the scientific production of energy. The old huddled dynamo room, slimy with oil and encrusted with dirt, has nearly disappeared from the face of the earth. Even the boiler room peopled by grimy firemen is on the wane and now generally presents a vista of neat furnaces with slowly moving feed shafts and a few skillful workmen seeing that the coal goes where it will do the most good. Even hand-fired furnaces present a far more orderly appearance than of old. In the new Waterside station the interior of the operating rooms proper is comparable with that of a fine office building. The net result of this case will very certainly be apparent in the upkeep and in a spirit of efficiency and *esprit-de-corps* that has a value far above dollars in promoting good service. Few people who are not intimately acquainted with central-station work have any adequate idea of the change in temperament, so to speak, that the last decade has wrought. There is vastly more effective pulling together than there used to be, and of late there has been a tendency to far better relations with the public. It is no uncommon thing to hear a central-station manager in the privacy of his own office and to his own staff speak fairly from the point of view of the publicist. Big, broad-minded men have now grown up in the business, and if they were given a fair chance by the powers in financial control, would establish public service on a far better basis than has ever yet been known. The world really moves faster than the public at times, and this is often evident in the central-station business in spite of hostile legislation and unreasonable restrictions. Electric service has passed from being a luxury to being a necessity, and these great central stations are monuments to the change. Fancy for a moment what would happen were electric service in New York to stop for even 24 hours. There would be either demoralization of commerce and industry and by another day pandemonium would break loose. The growth of such service has been so gradual that we can hardly realize its importance. Were an accidental shut-down possible it would be almost worth the while merely as a lesson on the fundamentals of modern life.

The Electric Vehicle Situation.

In the early stages of the automobile business the electric vehicle occupied the center of the stage, and it has been with considerable regret that electrical men have watched gasoline machines increase in numbers at a more rapid rate than the electric. Nevertheless, the electric vehicle has by no means been on the decline, and if the development of the electric automobile business in some of our cities is any criterion, the near future is full of encouragement. The central-station companies in various cities certainly can make no mistake in encouraging this business in every way. One trouble with the electric vehicle has been that too much was expected of it in the early stages of the art. Various companies rushed into its manufacture, but, strange to say, storage batteries did not alter any of their previously well-known characteristics and objected to neglect and mistreatment just as much when placed on an electric vehicle as when used in any other way. Almost as much improvement has been made in batteries and vehicles in 10 years as has been made in gasoline automobiles, but many of the old traditions still seem to cling to the electric vehicle. One of these is the fallacy that a large mileage on one charge is essential to ordinary business about town. The average electric vehicle, as built to-day, has considerably more available mileage on one charge of battery than the average vehicle of 10 years ago, and what is more, has a considerably greater mileage available than is actually needed in the ordinary run of business or pleasure, except where a long tour is undertaken. The best accepted practice now as to charge and discharge of vehicle batteries allows the vehicle owner more latitude than in the old days, not only by giving better mileage and greater durability of batteries, but in allowing the vehicle to remain partially discharged. The old idea was to keep the batteries as fully charged, and as far away from the point of complete discharge, as possible. In the last few years it has been learned that repeated overcharging is detrimental, and that a battery if discharged regularly down to 1.9 or 1.8 volts per cell will last longer than if only partially discharged between the rechargings. The life of the battery is somewhat dependent on the number of completed charges which it receives, and consequently the practice of fully charging every day a vehicle which has been run only a small fraction of its total available mileage is being discontinued as far as possible by owners and garage operators.

There is an immense field for the electric vehicle without it in any way attempting to perform the same feats as the gasoline machine—the field of every-day use by business men and by the fair sex. Indeed, it is especially noticeable in cities where electric automobiles are seen in greatest numbers that the electric vehicle is extensively used by the ladies. From experience in cities where a large number of electric vehicles are in use, it appears that the income per vehicle to the central-station company can be counted as about $5 per month, at a 6-cent per kw-hour rate, taking the average from one year's end to the other. An income of $60 per year for a 3-kw load which is on during the peak is not sought after by a central-station company which intends to remain out of bankruptcy. Automobile charging, however, does not, from its very nature, come on during the peak-load period, and consequently the only investment over and above that necessary for carrying the regular lighting load is in the service wires, meter and transformer. The electric automobile business can only experience its best growth in cities where proper provision is made for the care of batteries. If a central-station company wishes to encourage this business, it is essential that this matter be thoroughly looked into. In some cities the central-station companies have stood behind the bat-

tery-maintenance business, either directly or through the medium of some garage operating company. It is not always necessary to do this if there is a garage in the city which is properly equipped both as to men and materials for maintaining batteries. In a large number of garages, however, the electric is so secondary to the gasoline business that the electric vehicle does not receive proper attention. Many garage owners and operators are men who have come up through the bicycle or gasoline engine ranks, and it is not to be expected that they should either love, or be proficient in, battery maintenance. Where there are no good battery-maintenance men in a town, it is clearly up to the central-station company to bring them there if it wishes to get the electric automobile business on a good footing.

THE FAN MOTOR AND THE CENTRAL STATION.

With its popularity ever increasing and its design ever improving in detail, the electric fan becomes more and more a proposition for central-station encouragement and exploitation. As indicative of the attitudes of central stations toward the electric fan, the articles appearing elsewhere in this issue are suggestive. In some cities the policy of the company is to leave the matter of fans entirely in the hands of the contractors and supply houses. Others have found it profitable to sell the fans outright or to rent them for a stipulated sum per season, while a few companies install fans on a flat-rate basis. The actual number of fans in use is not ascertainable in the majority of cases nor the exact revenue from them, since they are connected to the lighting circuits and the energy is not separately metered. While the estimate given in a number of instances of the revenue received cannot in the nature of things be accurate, it nevertheless indicates that fan business is worthy of every encouragement.

As with many other electrical devices, the greatest obstacle to the introduction of fan motors is in the first cost. Many customers would gladly pay the expense of operating, but hesitate at the purchase price. The profit involved in the sale of fan motors is sufficient to make the business attractive to local contractors and dealers if such exist in a town, and the more of these the central-station company can get to handle fans, the more lively the business is likely to be. It is even advisable in some cases to get hardware or other stores to handle a few fan motors, even where they deal in no other electrical supplies, in order to stir up public interest. It is well to remember that fans are now made in smaller sizes than formerly. In many cases a 10-in. fan will suit a customer better than a 12-in. or 16-in., and the cost is lower.

When the fan season opens it should be the work of the central-station manager or solicitor to locate the places in his territory where fans are specially needed. When he finds such places, a few days' free trial will be found an aid. The possibilities as to the number of fan motors that can be sold in a town are likely to be underestimated. In a small town of 2500 inhabitants in southern Illinois, 43 fans were ordered and connected before a promised day service was even started, though usually it is considered impossible to get motor customers until after day service has been actually in existence for some months. In this case the motors were paid for in cash and were sold entirely by a contractor and dealer, no inducement in the way of installment payments being offered.

AUTOMATIC DEVICES FOR SYNCHRONIZING ALTERNATORS.

Ever since alternators have been operated in central stations their synchronization has been a matter of great practical importance. In the early days, with alternators giving frequencies of 120 cycles to 140 cycles per second, it was regarded as unsafe to attempt to synchronize them, and they were allowed to operate independent circuits only. As the art of alternating-current distribution developed, the necessity for, and capability of, synchronizing alternators became well established, and no central-station manager would now contemplate any other method of operation. At first incandescent lamps were used as synchronism indicators, but latterly rotary synchronism indicators have been widely adopted. An automatic device for synchronizing alternators is described by Herr Fritz Lux in an article in the *Electrotechnische Zeitschrift*, which is abstracted in the Digest. Electromagnetic mechanism, operated jointly by the operating and the incoming alternator, serves to throw the connecting switches at the proper moment. A machine for the same purpose has also been devised in this country. It seems doubtful whether such automatic synchronizers will come into extensive use. The amount of damage that might be effected by an accidental error on the part of the instrument is so great that most central-station operators would prefer to trust to rotary indicators and to synchronize manually.

ORGANIZATION OF TECHNICAL BODIES.

From a recently published account of the International Telegraphic and Telephonic Conference held at Budapest last year, it appears that this country, as in the case of several other international professional meetings held within the past few years, was not represented. It is much to be desired that America should send delegates to such conferences in the future. Whether the particular systems or devices employed in this country resemble or differ from the corresponding systems or devices employed in Europe, much is gained by international comparison and discussion. No nation can, in this century, afford to stand aloof in technical discussions. It was the absence of American representation at an international telegraph conference of government representatives half a century ago that accounts for the fact that we have a somewhat different telegraphic code from that of the rest of the civilized world. The international code of Europe was agreed upon as a mutual compromise at that conference. It is reasonable to suppose that had America been represented we should also have subscribed to the international compromise, and have adopted the international code here. As it is, wireless telegraphy is making the contrast between the international and the American code daily more burdensome and more prominent.

Another inference to be drawn from the Budapest conference is that engineers naturally subdivide themselves into groups, following the lines of industrial applications. Telegraph engineers tend to group themselves with telegraph engineers, and not with telephone engineers, or electric light and power engineers, so long as telegraphy is operated industrially separately from telephony, lighting or power. When, however, telephony is operated industrially along with telegraphy, telephone and telegraph engineers tend to meet in joint concourse exclusively of engineers in railway, light or power systems. No institute of electrical engineers, as a whole, can satisfy the needs of electrical engineers in separate industrial branches, unless

special sections are created for fostering the requirements of those branches individually. In this country, there is no reason why the American Institute of Electrical Engineers should not satisfy the technical needs of all branches of engineers engaged in electrical work. Yet we have seen electrochemists secede as a separate body and swarm by themselves. We have also more recently seen illuminating engineers, wireless telephone engineers and car-lighting engineers follow a similar divergent course. Indications point to further narrowing of the professional activities of the parent body, particularly as relates to the operating side of electrical engineering. If telegraph and telephone engineers were sufficiently numerous in this country, they would probably do likewise. The only hope of preventing such schisms, which are unnecessary, deplorable and adverse to mutual advantage, would appear to be the creation of sections within the main body, devoted to particular industrial applications. This course has already been followed to some extent by the American Society of Mechanical Engineers, as well as by the Street and Interurban Railway Association. Lacking some effective plan, to counteract present tendencies, the Institute may in time find itself narrowed to the university extension work which now appears to absorb much of the energy that formerly was expended entirely in the furtherance of its objects as a professional body.

The Tungsten Lamp and Revenue Reductions.

Some of the central-station companies which have been backward in introducing the tungsten lamp to their customers have recently been undergoing some unpleasant experiences as regards the effect of the tungsten lamp on revenue. The situation in these cases seems to have been about as follows: The central-station company has done nothing actively to make the consumer familiar with the tungsten lamp, the general theory being that it is best to let well enough alone so long as the consumer is satisfied with his existing inefficient installation. Sooner or later the local dealers and contractors have taken a hand in the game and have gone direct to some of the largest consumers offering an installation of tungsten lamps on the ground that it would make a great reduction in bills. Some large installations have been made, and the companies have lost in gross earnings because of the reduction of current effected by the tungsten lamp, and also in reputation because they did not call the attention of consumers to these lamps before they were introduced by the contractor. The wise course, and the one that has been pursued by the truly progressive companies, has been to call the attention of consumers to these lamps, explain their fragility and tell each consumer that two to three times as much light can be obtained for the same energy consumption as with the present carbon-filament lamps. The majority of consumers, if dissatisfied enough with present bills to buy tungsten lamps, are willing to pay the same bills as formerly if they can obtain the promised increase in light. The result of this is to raise the standard of illumination to which customers are accustomed, and there is no opportunity for the consumer to feel or say later that he was not given the benefit of tungsten-lamp economy.

Earnings of Lighting Plants.

The recent census statistics of central-station plants for 1907 throw an interesting light on questions of output and income for the industry as a whole. It was shown that the total receipts of the 4714 systems or plants in this country were $175,642,338. It was also stated that the output of the stations had been 5,858,121,860 kw-hours. This works out at almost exactly 3 cents per kw-hour, which seems low. It is to be borne in mind, however, that this includes a large amount of energy transmitted from simple generating plants, where the price obtained would be far below 3 cents. It also includes a great deal of arc lighting, which is inevitably done at a low figure, often at a rate for public lighting that does not meet the cost of production and service. In many of the cities also large bulk contracts for electrical energy or "power" are being increasingly taken, where a low rate is necessary to secure and hold the business, so that, as in Chicago, 3 cents might easily be a high figure for the service given to the street railways.

In this connection as bearing on earnings in the large cities, figures have recently been available as to the output and earnings of the New York Edison system in 1907, the same year as the census figures. The number of kw-hours sold to the public is reported as 209,024,000, for which the company received an average price of 6.49 cents, with a total cost of production of 4.69 cents per unit. These are not high rates of income or profit when judged by the margins deemed safe in other industries. The figures for the country as a whole show a producing cost per unit of very nearly 2.3 cents, so that the central-station business as a whole is being conducted upon a margin of 0.7 cent profit per unit. It ought at least to be 1 cent or more per unit for most plants, if they are to be good investments and to invite new capital.

As the installed capacity of American lighting stations is given as 2,642,403 kw in 1907, the yield would appear to be slightly over $66 per kw. If the population of the country be taken as 80,000,000, the consumption would reach about 73 units per capita, and the watts installed about 33 per capita. President Mordey, of the British Institution of Electrical Engineers, in his recent inaugural address reached a careful estimate for Great Britain of somewhat less than 25 units per capita there, and watts installed as 21.8. His data were not for the whole country, however, but for 18 cities, so that the average would probably be lower if all of the 44,000,000 of people were included. On the whole, therefore, the American data show up very well, but it is to be feared that the 100 per cent increases over 1902 will not again be shown in 1914 unless the companies enjoy treatment somewhat more favorable than has of late been accorded them by legislatures, commissions and city councils.

Uniform Central-Station Rate.

Of all the kinds of rate regulation occasionally proposed for electric light and power companies, the most disastrous in its effects on the public and on the companies is the plan of requiring a uniform rate per kw-hour to all customers for all classes of service. The fundamental idea of such legislation—namely, the prevention of discrimination—is right. The prevention of this discrimination by all kinds of public service companies is being more fully insisted upon each year by the public. However, to require a uniform rate for all classes of service given by electric light and power companies is as unwise and unjust as would be the requirement of a uniform rate for all kinds of freight. There are fundamental economic reasons why it costs more to serve some classes of customers than others. In the case of railroad freight, for example, it is evident that the railroad can handle coal and grain cheaper

than small, fragile packages. To insist on the same rate for all classes of freight would simply result in restricting the shipment of bulky necessities, such as lumber, and would allow shippers of small packages service for which they did not pay. Uniform rates per kw-hour for all classes of service by an electric light and power company would practically mean that the large consumer who uses current many hours per day could not afford to take central-station service because of the high price which would be charged. The expenses incurred in serving the small short-hour consumers would have to be paid for in part by the revenue obtained from the large and long-hour consumers, with the result of practically restricting the business to the small consumers. This in itself would keep the cost of production higher than if a larger variety of business could be done by the central-station company. In the end the rates to the small short-hour consumers would be higher than if the uniform rate were not required, and the larger consumers would be forced to the inconvenience of putting in isolated plants. The whole tendency of central-station practice the past few years has been away from the uniform rate idea, and, in fact, one of the things which restricted central-station progress for a number of years was the failure to recognize the great difference in cost of serving different classes of consumers. Rate systems which automatically give lower rates to certain consumers because of a greater number of hours' use of electricity per day can in no sense be called discriminatory, because they are open to all and are dependent entirely on the kind of service demanded. It is safe to say that no legislation which requires a uniform rate per kw-hour for all kinds of electric light and power service will be sustained by the courts, but it is troublesome, nevertheless, to have such legislation proposed.

SUMMER CENTRAL-STATION RATES.

Occasional central stations, both here and abroad, make special rates to consumers during the months of light load in summer when the peak is practically absent, or rather transferred—what there is left of it—to the evening hours. The result of this policy is the securing of enough extra business to compensate for the reduction of price. There are, of course, certain things like small electric cooking outfits and fan motors that belong especially to the warm months, and these are more and more freely used as the price of energy is lowered. In addition there is a certain opportunity for gaining extra use of lights. At all events, the policy has seemed to be fairly successful where tried and perhaps it deserves wider exploitation. Of course, from a practical standpoint it is more or less of a bargain sale, that does not very well fit ordinary theories of rates, but may none the less be advantageous. During the summer months the load upon a station is very moderate, and the whole investment for the winter peak confronts one. Taking fixed charges into account, the station, if it bases its rate on the cost of supply, might very well find that logically it should charge more in summer than in winter. However, although the theory of charging each and every customer a rate proportionate to the cost of supplying him is on paper a popular one, it is more honored in the breach than the observance.

On such a basis there is no defensible ground for making any intrinsic difference between current supplied for lighting and for power; a thing which is well-nigh universal in electrical supply. The fact is that central-station supply is like any other business, and must look after the large results in profits rather than petty details. It must make its total earnings pay its dividends, and to do this must sell its product on the average at a profit while putting it as regards individual customers at a figure that is attractive. The one thing which estops it from bargain sales is its duty as a public service corporation, which compels it to treat its customers as nearly alike as may be. All existing systems of rates are therefore more or less illogical compromises. From this point of view a summer rate which will get increased earnings even at modest profit is an entirely business-like proceeding, the sole question being with respect to its expediency. This depends in part on the general temper of the community and in part on the legal restrictions that commonly surround the matter of rates. If a company in virtue of an extra discernment can take on a paying load of cooking apparatus, fans and extra lights as for signs and the like, we see no good reason why it should not be allowed to do so. Electric kitchens are certainly a great convenience, and especially so during these very summer months that are in question. Their use is economical at any time below a certain price per kw-hour—for instance, at such rates as are often charged for motor service. If a general summer rate could be made on both lights and cooking devices, the increased consumption for both purposes ought to be able to bring in an increased income that would be worth while.

Another class of business that might be increased is summer specialties in signs. During the warm months, when people are much out of doors, special advertising with electric signs ought to pay, and from the central-station standpoint it would be a good kind of load to develop. Electric signs seem to form a stable part of the business. They hang on at dull times in a way that is very gratifying and are in good times steadily on the increase. How far special summer rates would increase their installation remains to be discovered. Probably some of the summer gain might be carried on through the rest of the year. A successful summer rate scheme certainly implies an active campaign for extra load appropriate to the season, with an excellent chance for retaining part of the increase. The difficulty is to determine what the special rate should be and how it could be most tactfully made. That really is a thing which is of local significance rather than of general application. It would be a difficult step to arrange a summer rate on some systems of charging and a rather easy one upon others. The more leeway allowed in general, the easier would be special arrangements. The time has come for central stations when new business must be hunted and bagged. In spite of the huge increase in totals shown in the recent census report, the need of activity is still obvious when one comes to analyze the situation. The greatest gain has been in motor service, helped on by the establishment of great specialized power plants. The least increase, to judge from observation, is in domestic lighting, on which the gas companies have in the larger cities a very strong grip. Until by one device or another this is broken, the gas companies have a steady and reliable pot-boiler that enables them to carry on an active fight for larger work. The summer schedule, involving much residence work, is therefore a weapon of offense that the central station should not throw aside without careful investigation.

Electrical Features of the Inauguration.

As has been customary in the past, the Capital City has put on festive attire for the inauguration of the President on March 4. This year electricity plays an important part in the decorative features. Pennsylvania Avenue from the Peace Monument to the Treasury Building is festooned with electric lamps, the entire electrical display culminating in the Court of Honor in front of the White House. The lines of decoration in the Court of Honor extend from Fifteenth Street to Seventeenth Street with parallel rows of columns at the curbs at each side of the street. The columns are approximately 25 ft. high and from the top of each there is a festoon of flowers intertwined within which is a string of 8-cp lamps spaced 12 in. apart. At the top of each pole is a banner and an electric emblem. Where the streets join there are four 45-ft. columns 4 ft. in diameter at the top. Surrounding the base of each of the four large columns are six 20-ft. columns. These smaller columns are entwined with floral decorations and electric lamps and the large columns are circled with receptacles at various points. At the top of each of the four large columns is a mammoth flower basket made of wicker work with electric lamps placed in each of the apertures. There are 150 lamps in each flower basket or a total of 600 in the four baskets at each street intersection. Connecting the columns is a series of festoons forming a hollow square, together with diagonal festoons. These festoons are made of laurel and are studded with 8-cp lamps spaced 9 in. apart. At the center of the festoons are emblems consisting of trophies, shields and the American eagle, all of which are outlined with electric lamps. At the intersection of the diagonal festoons there is a 3-ft. ball studded with 200 lamps. This design is repeated at the intersection of each of the streets. The total number of lamps used in the Court of Honor is 7000, all rated at 8 cp. The energy is supplied by the Potomac Electric Power Company, the feeders being located at the intersections of the streets and the control boards being placed in each of the high columns. The work was installed by The Electric Motor & Equipment Company, of Newark, N. J., under the direction of the Inaugural Committee. The general design of the work is such as to make the Court of Honor the most elaborate ever installed in Washington. The grand ball will take place as usual in the Pension Building, the electrical decorations here being installed by the National Electrical Supply Company, of Washington. Myriad incandescent lamps are used in connection with flags, bunting, festoons, etc., adding greatly to the already dazzling effect of officers in uniform, diplomats in court attire, civilians in regulation dress and women in evening gowns.

Edison Incandescent Lamp Leading-in Wire Patent Sustained.

Another incident in the rather remarkable legal history of the Edison incandescent lamp leading-in wire patent was the reversal on Feb. 16 by a United States Court of Appeals, of the decision on May 14, 1908, of a Circuit Court declaring the patent invalid on the grounds that it merely related to a mechanical improvement. Both of these decisions were rendered subsequent to the expiration of the term of life of the patent, which occurred Jan. 13, 1908. The original patent was the subject of numerous suits of infringement instituted about 1904. On the grounds that the claims of this patent were too broad, a reissue was obtained Oct. 10, 1905, and the present suit was based on the reissued patent.

In discussing the claim of anticipations of the invention, the court held that in Heisler and Bernstein lamps exhibited, the complete sealing-in occasionally of the platinum wire was by mistake and that no such accidental and fugitive occurrence is of account. In the Lemp & Wightman patent adduced, the court held that it was by the error of a draftsman that the outer section of the leading-in wire is apparently made to extend into the glass. The patentability of the device was declared to be the real question, and the court held that Edison's successful method in dealing with the subject, and particularly the method adopted, was inobvious if not obscure, calling for inventive insight to develop and discern, and that the patent therefore should have been sustained.

The Kellogg Telephone Suit.

A decision of the Illinois Supreme Court, Friday, Feb. 19, 1909, concluded a long and bitterly contested litigation, the result of which restores to Mr. Milo G. Kellogg his stock control of the Kellogg Switchboard & Supply Company, which had been acquired by the American Telephone & Telegraph Company. In November, 1901, Mr. Milo G. Kellogg, president of the Kellogg Company and owner of nearly two-thirds of its issued stock, was forced by severe illness to resign his active management of the Kellogg Company and prior to his departure for California, he resigned his management to the vice-president of the company, Mr. Wallace L. DeWolf, and gave him a power of attorney. This power severed both personal and corporate interests of Mr. Kellogg, and acting under it Mr. DeWolf, on Jan. 4, 1902, sold to Mr. Enos M. Bartle, president of the Western Electric Company, all of Mr. Kellogg's stock as well as his own and that of others. Mr. Kellogg was not advised of this sale, or attempted sale, until six months thereafter. Upon learning of it, and as soon as his health would permit, he took active steps to recover his stock.

The original bill in this case was filed in June, 1903, by Francis W. Dunbar, Kempster B. Miller, George L. Burlingame, and other minority stockholders in the Kellogg Company. These stockholders contended that a purchase of a majority of the stock of the Kellogg Company by the American Telephone & Telegraph Company tended to suppress competition and create a monopoly and was therefore illegal and void. To this the American Telephone & Telegraph Company replied that the bill of the minority stockholders was insufficient to warrant granting the relief prayed for, and Judge Mack, in the Circuit Court of Cook County, Illinois, held the bill insufficient. An appeal was then taken to the Branch Appellate Court of the same county and there Judge Mack's decision was affirmed. The minority stockholders then appealed to the Supreme Court of Illinois and this court, in an opinion handed down Oct. 23, 1906, reversed the two lower courts and established as the law of this case that a foreign corporation, such as the American Telephone & Telegraph Company, doing business in Illinois, had no greater powers than a domestic, or Illinois, corporation and that an alleged purchase by the said American Company either in its own name or in the name of others, of a majority stockholding in a rival company for the purpose of controlling it and thus stifling competition, was illegal and absolutely void.

It remained to prove the allegations of fact contained in the bill, and accordingly the case was remanded to the Circuit Court of Cook County and the proofs produced before Judge Windes of that court. A number of months were consumed in adducing these proofs. After argument before Judge Windes he found the allegations of the minority stockholders' bill substantially proved and, under the law as determined by the Supreme Court, ordered a decree entitling the minority stockholders to all the relief prayed for. The decree of Judge Windes was entered in February, 1908, and awarded the minority stockholders a permanent injunction perpetually enjoining the American Telephone & Telegraph Company and its agents from, in any manner, interfering with the management or control of the Kellogg Company. The decree also ordered that the said American Company surrender the Kellogg certificates of stock illegally acquired by it, to their rightful owners, and that the purchase price of said certificates be returned to it. Also, that should the said American Company refuse to surrender said certificates, they would be cancelled and new certificates issued.

The American Telephone & Telegraph Company then carried the case to the Branch Appellate Court and that court, while

finding the alleged facts substantially proved, disagreed with Judge Windes on the relief to be granted to the minority stockholders. The minority stockholders then carried the case to the Supreme Court of Illinois, and on Feb. 19 that court reversed the Branch Appellate Court, sustained Judge Windes, and affirmed his decree in its entirety.

Proposed Connecticut Public Service Commission.

Governor Lilley sent a message on Feb. 25 to the General Assembly asking that it give early attention to the bill to establish a public service commission. He said that the immense complexity of modern business conditions has rendered the supervision of public utilities imperative. Such supervision is not practicable under the present system, as the Legislature meeting only every two years for a few months cannot give these matters the careful scrutiny which the people rightfully demand. He believed that the same source from which grants of special privileges flow should be in session at all times to see to it that those special privileges which are granted for the benefit of the people are exercised in the interests of the people.

Michigan Public Service Commission.

A bill before the Michigan Legislature provides for transforming the State railroad commission into a public utilities commission with jurisdiction over all companies and corporations, private or municipal, providing telephone service, heat, light, power or water to the public. Representative Garry E. Sanders, of Ingham County, is sponsor for the bill. The bill provides that the commission may prescribe a uniform system of bookkeeping, require an annual printed statement of each company's financial and physical condition and examine the books whenever it desires. The commission is to fix rates, and adequate standards of measurement and make investigations of alleged oppression or discrimination upon complaint of 10 persons. In no case shall the commission fix a substitute rate without giving the company a hearing, and the company shall have the right of appeal to the Circuit Court.

The Institute Dinner.

Everything points to a very successful anniversary dinner of the American Institute of Electrical Engineers at the Hotel Astor, New York City, on March 11. All the preparations have now been carefully made, and the number of applications for seats is very large. The dinner will be conducted by President Ferguson, who will act as toastmaster. Prof. Elihu Thomson will speak for "The Charter Members;" Mr. Frank J. Sprague for "The Past Presidents;" Dr. A. C. Humphreys, president of Stevens Institute of Technology, will speak on "Electrical Engineering and Education," and Mr. John Bogart, formerly State Engineer, and secretary in 1884 of the American Society of Civil Engineers, will bring the "Greetings and Congratulations of Sister Societies," several of which will be represented by their officials. An interesting feature of the dinner also will be the participation of a number of branches and sections. The dinner committee makes an earnest request that applications for tickets and seating will be filed at once, so that attention can be given to this important matter well in advance of the affair. The cost of the dinner is only $5, including one wine and cigars and cigarettes, music, etc. The dinner will be given in the large ballroom, using the small ballroom adjoining as an annex if necessary.

Grand Falls Power Company.

The contract for the construction work involved in the hydro-electric development of the Grand Falls Power Company on the St. John River, at Grand Falls, N. B., has been placed. This plant will generate 100,000 hp in electrical energy, which will be furnished to various cities throughout New Brunswick and Maine. The work involves, among other features, the construction of a number of shafts in rock excavation 130 ft. deep, a power chamber 30 ft. x 260 ft. and 130 ft. deep, and a tail-race tunnel 28 ft. in diameter and 2400 ft. long, a power house 350 ft. long and 260 ft. wide. The intake shafts will be nine in number and 12 ft. in diameter and 130 ft. deep. The plant will be equipped with the most approved hydraulic and electrical machinery for high-potential and long-distance transmission. Actual construction will, it is stated, be begun immediately and will be pushed through to completion at an early date.

The water power of the falls on the St. John River at this point is the largest in eastern Canada and its development will result in the establishment of a large number of manufacturing enterprises. The total head developed will be 135 ft. A number of auxiliary substations and long-distance transmission lines will be erected. The St. John River at Grand Falls (which is the largest river in New Brunswick) describes a horseshoe curve at this point and has a fall of 135 ft. through a gorge of great beauty. Grand Falls is situated on the Canadian Pacific Railroad, about 200 miles north of St. John, N. B., and about two miles east of the State of Maine.

The expenditure involved will amount to over $5,000,000. The contract for construction work was awarded to the Frank B. Gilbreth Company, of New York. Mr. John B. McRae, of Ottawa, is chief engineer for the development and Mr. Ralph D. Mershon, of New York, is the electrical engineer.

Ontario 110,000-Volt Transmission System.

The Hydro-Electric Power Commission of Ontario has let contracts for the building of 300 miles of 110,000-volt transmission line. Energy will be bought from the Ontario Power Company, at Niagara Falls, and will be distributed by means of the high-voltage circuits to Toronto, Hamilton, London, St. Thomas and various intermediate points in this part of the Province of Ontario. The line will require about 500 tons of aluminum cable, and about 7500 tons of steel will be used in some 3200 towers. It is expected that the line will be ready for service before the end of 1909.

The line starts at the transforming station at Niagara Falls where the e.m.f. will be increased from 12,000 volts to 11,000 volts. The initial installation will be for 30,000 kw. From Niagara Falls the line extends about 50 miles in a northwesterly direction to Dundas, at which point it divides. One line, about 40 miles long, extends in an easterly direction to Toronto, while two others go westerly to London; the northern of the latter two branches covers about 120 miles and the southern about 75 miles. From London the line proceeds westerly to St. Thomas about 14 miles. An additional extension to Windsor, about 100 miles, will subsequently be made, probably within the present year.

The poles are to be galvanized steel angle-iron towers. The standard spacing will be 550 ft. On curves the spacing will be reduced to 100 ft., while at Humber River a distance of 1250 ft. will be spanned. The tower will be placed on framed steel anchorages 6 ft. below the ground contour. The normal height will be about 65 ft. above ground; at the Welland Canal extra high structures will be employed, because a clearance of 150 ft. is required to permit the passage of vessels.

The three-phase conductors will be of stranded aluminum, having a cross-section of No. 3-0 B. & S. gage uniformly throughout with the exception of the line from Niagara to Dundas, where a cross-section of No. 4-0 will be used. The insulators will be of the disk suspension type, five disks being employed for each conductor. A grounding cable for lightning protection will be arranged along the highest point of the towers.

The general contract for the construction of the line has been let to Mr. F. H. McGuigan, of Toronto. Sub-contracts have been let to the Canadian Bridge Company, of Walkerville,

for the steel towers, to the Northern Aluminum Company, of Shawinigan Falls for the cables, and to the Niagara & Ontario Construction Company, of Toronto, for the balance of the material and the actual erection of the line. Muralt & Company, New York, have been retained as engineers and will supervise the construction. Mr. C. L. de Muralt will personally take charge of the work.

Morse Club Dines President Brown.

The annual dinner of the Morse Electric Club, which is practically an organization made up from the Western Union executive ranks, was held at the Hotel Savoy, New York City, on Saturday evening, Feb. 27. The guest of honor was Mr. William C. Brown, who has just been elected president of the New York Central system, and who was enthusiastically greeted as one of themselves because he began life as a telegraph operator. About 200 members and guests were present and an excellent dinner was served. Among those in attendance were: J. B. Van Every, who presided; Vice-Presidents J. C. Barclay and B. Brooks; A. R. Brewer, W. H. Baker, R. D. Brixey, M. R. Cockey, Gardner Irving, M. H. Kerner, J. Kempster, W. Marshall, M. J. O'Leary, C. L. Pullen, J. B. Taltavall, C. Trippe. The *Electrical World* was represented by T. C. Martin, and the *Electric Railway Journal* by J. M. Wakeman. At the speakers' table sat the guest of honor and President Van Every, supported by President R. C. Clowry, of the Western Union Telegraph Company; Justice Morgan J. O'Brien, Hon. P. H. Dugro, H. D. Estabrook, E. T. Jeffery, C. F. Daly and W. J Dealy. Before speaking began, a number of songs were sung, which were printed on a supplement to the menu.

President Brown in acknowledging the toast in his honor made some very interesting personal allusions to the beginning of his career in the West, his father having been a missionary to Iowa 60 years ago, where the family had to undergo the privations and perils of frontier life. Mr. Brown began his work as a young railway telegraph operator, whose duties included the stacking of cordwood and handling of freight; and in a modest manner he told how he had made the successive steps which have finally brought him to a position as the foremost railway manager in the United States—but still in the electrical field. Extremely interesting reminiscences of a like nature were also given by Col. Clowry and Messrs. Estabrook and Jeffery, all of whom had been acquainted with the guest in the earlier days out West. Mr. Dealy made an eloquent address, as usual, discussing Mr. Brown's characteristics as an operator and as a man. Justice O'Brien delivered a simple, dignified speech, in which he discussed with force and earnestness the difficulties with which such men as Mr. Brown now found themselves surrounded and confronted through the unintelligent and reckless legislation which had been put into force hostile to the railroads. The same spirit had also been manifested with regard to other large corporations, such as those in charge of telegraph systems, but he believed in the sober commonsense of the American people, and felt that in time better judgment in these matters would prevail, and it would be realized that the welfare of the corporation was one with that of the public. This brought to its close an altogether enjoyable and pleasant evening, which will be long remembered by all who participated.

Control of Niagara Power.

The attempt of Congressman Burton to have the provisions of the bill regulating the Niagara power development extended for a period of 10 years met with so many objections that a compromise on a two-year extension was effected—the joint resolution on the question states that the provisions of the act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls and for other purposes, approved on June 29, 1906, will expire by limitation on June 29, 1909; that the date for the termination of the operation of the act was provided only with a view to the more permanent settlement of the questions involved with Great Britain and by further legislation appropriate to the solution; and that as such treaty has not been negotiated, it is desirable that the provisions of said act should be continued until such permanent settlement can be made. The resolution adopted states "that the provisions of the aforesaid act be and they are hereby extended for two years from June 29, 1909, being the date of the expiration of the operation of said act, save in so far as any portion thereof may be found inapplicable or already complied with."

New York Public Service Commission Work.

The Public Service Commission of the First District of New York has issued an order requiring the Empire City Subway Company and the Consolidated Telegraph & Electrical Subway Company to file report for the six months ending Dec. 31, 1907, and for the year 1908. These companies, which control the conduits carrying various sorts of electrical wires in this city, have maintained that they were not under the jurisdiction of the Public Service Commission. It has not yet been decided whether the companies will contest in the courts the point or will accede to the order.

The commission has also sent to the Board of Estimate and Apportionment a report on the present condition of the new subway loop between bridges in Manhattan Borough. In this report it is said that the reason why no contract for the operation of the loop had been advertised was because it would be impossible to get any other bidder than the Interborough Company until after the construction at the Brooklyn end of the new Manhattan bridge had been contracted for. The Board of Estimate is censured for not having taken action on the contracts for the Brooklyn construction which were submitted to it by the commission last May. The commission says that if the Board of Estimate insists that only the first section and part of the second section be constructed at this time—as has been stated—that the commission is ready to take the matter up on that basis. It insists, however, that the city's debt is now $48,000,000 below the constitutional limit and that therefore it would be possible to begin construction on all six sections of the Brooklyn subway at once. The Board of Estimate has not, as yet, made any response to the communication.

The Public Service Commission of the Second District of New York is still trying to force Mr. Herbert P. Bissell, president of the Economic Power & Construction Company, to answer certain questions concerning the business affairs and methods of his company. It has just taken an appeal to the Appellate Division of the Supreme Court from the decision of Justice Fitts, who ruled Mr. Bissell need not answer.

The Court of Appeals of New York has sustained the decision of the Appellate Division of New York City denying the motion of the Public Service Commission of the First District to quash the writs of certiorari obtained by the receivers of the Metropolitan Street Railway Company to review the proceedings fixing a fare of 5 cents to be divided between the Metropolitan company and the Fifty-ninth Street cross-town line. The commission directed the Metropolitan company to issue transfers and divide its fares. Upon this order the railway company demanded the court review.

Engineering Society of Wisconsin.

The organization of the Engineering Society of Wisconsin was completed at the first meeting, held at the University of Wisconsin, Feb. 24, 25 and 26, at which some 150 city engineers, general managers of power and traction companies, contracting engineers, superintendents of water and light plants, mechanical and civil engineers, and superintendents of highway construction were present and became charter members. The officers elected were as follows: President, Dean F. E. Turneaure, University of Wisconsin College of Engineering;

vice-president, City Engineer McClelland Dodge of Appleton. Trustees for two years: Mr. B. F. Lyons, assistant general manager of the Beloit Gas & Electric Company, and Mr. E. P. Worden, mechanical engineer of the Prescott Steam Pump Company, Milwaukee; trustees for one year: Mr. E. Gonzenbach, of the Sheboygan Electric Light & Power Company, and City Engineer E. R. Banks, of Superior. These, as executive board, will elect the secretary later.

The new organization will hold annual meetings hereafter for the purpose of bringing together the engineers from all parts of the State interested in the solution of such problems as arise in connection with municipal plants, large construction work, bridge, forest and water power questions, and light and power production. A wide range of subjects was included in the program for the initial meeting of the society.

Prof. W. D. Pence, who is engineer for the Wisconsin Railroad Commission, opened the second day's program with a description of the organization of the commission's engineering staff. The new problem of standards of gas and electric service was discussed by Prof. C. F. Burgess, of the department of applied electrochemistry at the university, who has done important work in enabling the State Railroad Commission to prescribe a standard for fuel and illuminating gas.

The electric interurban roads of Wisconsin were the subject of a paper by Mr. F. G. Simmons, superintendent of construction and maintenance of way for the Milwaukee Electric Railway & Light Company. The day circuit for small towns was discussed by Prof. J. W. Shustor, and new forms of arc lamps by Mr. W. E. Wickenden, also of the electrical engineering department. Dean Turneaure took the members of the society through the engineering experimental laboratories, explaining the work that is being done there in many lines of research. At a late session Prof. D. W. Mead discussed the subject of hydraulic and hydro-electric power development, and gas producers and small power stations were subjects of papers by Mr. V. E. McMullen, Beloit, and Mr. C. T. Atkinson.

Convention of Pacific Coast Electric Automobile Association.

Pursuant to a call sent out by Mr. R. B. Daggett, manager of the San Francisco office of the Electric Storage Battery Company, a meeting of those interested in the development of the electric vehicle business on the Pacific Coast was held at the St. Francis Hotel, San Francisco, on Feb. 19 and 20. There were over 50 delegates in attendance, representing vehicle distributors and central-power station companies, as well as manufacturers of vehicles and their equipment. The meeting was called to order by Mr. Daggett, who made a welcoming address, stating the object of bringing together those specially interested in the electric-vehicle business.

Papers were read as follows: "The Electric Vehicle," by Mr. R. B. Daggett, Pacific Coast manager Electric Storage Battery Company; "The Mercury Arc Rectifier," by Mr. R. M. Alvord, of the supply department of the General Electric Company; "Vehicle Batteries," by Mr. Geo. R. Murphy, engineer, Electric Storage Battery Company; "Relation of Central-Station Companies to the Automobile Business," by Mr. Fred. T. Kitt, agent, Columbus Electric Vehicle Company, Sacramento, Cal.; "The Electric Vehicle Motor," by Mr. J. T. Deremer, of the Westinghouse Electric & Manufacturing Company; "The Commercial Electric Vehicle," by Mr. A. C. Downing, Pacific Coast sales engineer for the electric vehicle department of the Studebaker Automobile Company; "Electric Pleasure Vehicles," by Mr. F. W. Pfaffman, of Los Angeles, representing Rauch & Lang, of Cleveland; "The Electric Garage," by Mr. S. P. Reed, of the Reed Electric Laboratory, San José, Cal.

A lively discussion followed the presentation of the papers, much interest being taken in the present and future status of the electric vehicle in San Francisco and the other coast cities.

The social features were well taken care of by the Electric Storage Battery Company and the Studebaker Brothers Company. They included a theater party, followed by a supper one evening and a banquet at the close of the convention. An interesting hill-climbing exhibition was given by Mr. William Harvey on Friday, who drove a Babcock electric up the Powell Street Hill, one of the steepest ascents in San Francisco. A general automobile run through Golden Gate Park had been planned, but had to be omitted because of inclement weather.

At the banquet on Saturday evening permanent organization was effected by the formation of the Pacific Coast Electric Automobile Association. Officers for the ensuing year were elected as follows: President, Mr. R. B. Daggett; vice-president, Mr. A. C. Downing; secretary-treasurer, Mr. J. T. Halloran. These three officers were constituted a governing board to manage the affairs of the association, select committees, etc. Oakland was selected as the place for the next annual meeting in February, 1910.

Details of Telephone Census Statistics and Methods.

The recent publication of the telephone statistics of 1907 by the United States Bureau of the Census has given rise to criticism in some "independent" telephone quarters, where disappointment is felt because the "independent" figures shown in the returns fall so far short of the claims made by interested parties. Under these circumstances, as a means of demonstrating the accuracy of the figures given in the general preliminary report, published in these pages on Feb. 4, Mr. W. M. Steuart, chief statistician of manufactures in the Census Office, has given out the subjoined table of detailed figures, State by State, which bring out the curious fact that the Census figures in the few disputed cases exceed those put forward from "independent" sources:

NUMBER OF STATIONS OR TELEPHONES, BY STATES, DEC. 31, 1907.

	Total.	Independent (Non-Bell).	Bell (American Telegraph & Telephone Company).	Independent stations connected with Bell System.
United States	6,118,578	2,986,515	3,132,063	*835,880
Alabama	40,481	14,985	25,496	3,944
Arizona	6,203	3,148	3,055	....
Arkansas	49,576	32,150	17,426	10,265
California	237,672	65,977	171,695	9,607
Colorado	65,908	4,473	61,435	1,620
Connecticut	63,898	1,815	62,083	352
Florida	17,522	11,160	6,362	3,691
Georgia	62,260	26,204	36,056	9,072
Idaho	16,394	5,754	10,640	1,288
Illinois	558,585	285,322	273,263	109,101
Indiana	289,452	216,990	72,462	50,065
Iowa	332,545	279,773	52,772	74,806
Kansas	200,233	161,913	38,320	66,880
Kentucky	93,996	51,796	42,200	9,038
Louisiana	35,692	6,184	29,508	4,351
Maine	53,134	16,024	37,110	7,830
Maryland, District of Columbia and Delaware	110,282	19,896	90,386	217
Massachusetts	209,383	5,324	204,059	650
Michigan	209,842	106,049	103,793	30,933
Minnesota	171,479	114,618	56,861	46,547
Mississippi	37,627	13,567	24,060	5,235
Missouri	312,527	220,823	91,704	82,393
Montana	17,168	8,118	9,050	846
Nebraska	153,279	105,610	47,669	45,252
Nevada	4,601	2,081	2,520	734
New Hampshire	28,920	6,488	22,432	2,482
New Jersey	116,988	19,134	97,854	831
New Mexico	6,653	3,476	3,177	759
New York	685,512	180,759	504,753	23,992
North Carolina	37,104	20,597	16,507	4,714
North Dakota	34,087	26,635	7,452	10,542
Ohio	495,636	312,278	183,358	29,284
Oklahoma	68,125	38,009	30,116	36,570
Oregon	49,629	16,223	33,406	10,675
Pennsylvania	450,403	174,582	275,821	11,976
South Carolina	20,911	7,872	13,039	1,867
South Dakota	48,405	44,751	3,654	25,939
Tennessee	71,130	25,758	45,372	9,241
Texas	187,862	108,832	79,030	30,334
Utah	30,630	10,528	20,102	451
Vermont	30,833	13,917	16,916	7,020
Virginia	55,541	24,118	31,423	4,447
Washington	98,846	35,652	63,194	9,168
West Virginia	62,144	46,609	15,535	3,238
Wisconsin	158,875	89,005	69,870	36,366
Wyoming and Rhode Island	30,605	1,538	29,067	1,267

*Figures furnished by American Telegraph & Telephone Company. Included in total for Independent.

In this connection Director North, of the Census Bureau, has addressed a careful and exhaustive letter of explanation as to Census methods to the Nebraska Independent Telephone Asso-

ciation, a copy of which has been given to the press. In the course of this he says:

"The statistics contained in this preliminary statement are, of course, subject to such corrections as may be found necessary upon a further examination of the reports and comparison of the tabulations. Subject to these possible corrections the 2,986,515 independent telephone stations may be accepted as the total number of such stations that were in operation during 1907.

"At the census of 1902 the office experienced great difficulty in obtaining a satisfactory enumeration of the small independent telephone companies and the farmer, or rural, lines. Therefore great care was taken at the census of 1907 to enumerate all lines of this character. In the first instance a complete card index was prepared, giving the names and addresses of all telephone companies and independent farmer lines. The basis of this index or list was the reports made at the census of 1902. But in addition to this, the postmasters throughout the entire country were required to furnish the names and addresses of all telephone companies and individual farmer or rural lines operating in their cities or immediate vicinity. State officials were also requested to furnish lists of the telephone companies in their respective States, and fairly complete lists were received from the majority of the States; county officials were requested to furnish lists of the names and addresses of farmer or rural telephone lines. These officials in a number of the States preserved records of this character in connection with the requirements of taxation, etc., and a great deal of information was obtained from them. All of the independent telephone associations were also requested to furnish the names and addresses of their members, and of any other companies or independent lines, and fairly complete lists were received from associations in at least 11 States. The International Independent Telephone Association of Chicago furnished a fairly complete list, names and addresses of telephone companies were also obtained from the city directories for all cities having a population of 50,000 and over.

"Blank schedules were mailed to all of the companies and individual lines named on the lists prepared from the sources indicated, and in addition to soliciting the statistics required for the census, each company was requested to give the names and addresses of all connecting farmer or rural lines and of other companies or lines in the vicinity. A large number of additional names were secured from this source. The original lists prepared from these various sources contained in the neighborhood of 35,000 telephone properties, but this total included a large number of duplications. However, the Office was not satisfied that it had a complete list, and therefore in arranging for the canvass schedules were in the first instance sent to the companies, and then the entire United States was subdivided into 84 enumeration districts and one or more agents assigned to each district. These agents were given the names and addresses of all of the telephone companies and farmer or rural lines located in their respective districts, and they were instructed not only to secure census reports from each company, but to make careful inquiry for any other companies and lines that were in operation during any part of the year 1907. Each agent was held to a thorough canvass of his district. I believe that by the application of these methods the entire country has been pretty thoroughly covered and that the Office secured returns from practically all companies and lines that were in operation during any portion of the year. In all work of this character, however, there is a possibility of some omissions, but in this instance the omissions are evidently very few and unimportant."

Chemical Elements.

At the February meeting of the Pittsfield Section of the American Institute of Electrical Engineers, Dr. W. R. Whitney, director of the Research Laboratory of the General Electric Company, in Schenectady, N. Y., gave an instructive talk on chemical elements, pointing out their different characteristics, such as atomic weight, melting points, etc. He stated that the various elements bear certain definite relations to each other, and may be arranged in natural groups according to their atomic weights. So perfectly has this arrangement been worked out that there is only one place in a group into which a given element will fit and it is therefore possible to predetermine with great accuracy the character of a number of elements which are known to exist but have not as yet been discovered. This knowledge of the interrelation between elements is also of great assistance in carrying on investigations as it often points out the way to new discoveries and new uses to which various materials may be adapted. For example, tungsten, of which the filaments of incandescent lamps are now made, was known to be suitable for this class of work long before it was possible to handle it commercially.

A Ladies' Electrical Luncheon.

The Buffalo General Electric Company entertained the Buffalo Chapter of the Daughters of the American Revolution and their guests at the Twentieth Century Club, in that city, on Feb. 22. The stage was arranged with a quaint old-fashioned setting, with wide fireplace, old-time open-hearth cooking utensils and 18th century furnishings. Just below the stage, in sharp contrast, was placed the most modern electrical kitchen, where electrical appliances were used for baking, roasting, broiling and coffee making. Many other household appliances were exhibited about the room, and the official insignia of the society was shown in electrical display above the stage. The total attendance was 1864, and luncheon, every part of which was electrically cooked in the room, was served to 1250 ladies. Color was given to the entertainment by the costuming of all the waitresses and attendants in Colonial dress. The entertainment was for the purpose of impressing upon the housekeepers the convenience and economy of electrical household appliances, which the Buffalo company is especially pushing.

British Illuminating Engineering Society.

An informal dinner was held at the Criterion Restaurant, Piccadilly, London, on Feb. 9, at which the formation of an illuminating engineering society in Great Britain was the subject of discussion. Mr. Leon Gaster presided at the meeting, which included representatives of the engineering, architectural, medical and other interested professions.

At the conclusion of the dinner Mr. Gaster briefly described the development and progress of the illuminating engineering movement in Great Britain, and explained the objects of the proposed society, namely, to provide a free and impartial platform for the discussion of questions connected with illumination. He emphasized especially the fact that what he proposed was an "illuminating engineering society" and not a society of "illuminating engineers." Anyone interested in furthering the science and art of illuminating engineering would be eligible to join the society, but membership would not entitle anyone to any professional status. In this respect the society would resemble similar and flourishing institutions already existing in Great Britain.

An animated discussion followed, in which all who spoke expressed their warm approval of the suggested scheme, and their conviction that the time was ripe for starting such a society. It was proposed and carried unanimously that the *Illuminating Engineer*, published in London, be appointed the official organ of the society.

CURRENT NEWS AND NOTES.

AMERICAN-GERMAN PATENT CONVENTION.—A dispatch from Washington states that a patent convention with Germany was signed Feb. 23 by Secretary of State Bacon and Count Johann von Bernst, the new German Ambassador. The treaty is designed to prevent either government from passing laws requiring that foreign patents must be manufactured in the country in which protection is asked. The treaty must be ratified by the Senate to become operative.

NO WIRELESS REGULATION.—Toward the close of Congress it was decided to let the whole matter of compulsory wireless legislation go over until the session of next winter.

WINNIPEG MUNICIPAL PLANT.—The City Council of Winnipeg, Manitoba, has asked the county court to investigate with a view to learn the reason of the excessive cost of work on the city's high-tension power plant, and ascertain why it has cost the city $200,000 to acquire what two responsible firms offered for $129,000.

EXTENSION BEYOND VILLAGE LIMITS OF MUNICIPAL SERVICE.—A bill has been introduced in the New York State Legislature authorizing the extension of the lines of village municipal electric lighting plants beyond the limits of villages. If, however, the estimated expense of such extensions exceed $500 in any year, the expenditure must be approved at an election.

WIRELESS TELEGRAPHY IN TRAIN SERVICE.—A special train on the Lake Shore Railroad was kept in wireless-telegraphic communication with Cleveland and Chicago while running at full speed between these places on Feb. 27. A temporary wireless station was installed in the buffet car, a wire arranged along the roof of the car serving as the antenna. About 800 words were sent and successfully received. It is said that additional tests will soon be made of the system to determine its reliability.

GREAT AMERICANS.—The *New York Herald* has recently been conducting a "competition" in which its readers have been asked to name the men whom they consider to be the 10 leading Americans. The work has just been completed, with interesting results. The list is headed by Mr. Thomas A. Edison, to whom comes Mr. Andrew Carnegie as second. The last in the 10 is Dr. Alexander Graham Bell, and just succeeding, outside the 10, is Mr. George Westinghouse. Mark Twain is the most popular author as one of the 10.

SAULT WATER POWERS.—The U. S. Senate has adopted an amendment to the Rivers and Harbors bill which provides that any water in the river of Sault Ste. Marie in excess of the amount necessary for the use of navigation shall be leased by the Secretary of War for power upon the payment of such charges as are reasonable and best adapted to insure the development and commercial progress of the communities affected. The House adopted a provision that the government shall take over the property of all the power companies except the Michigan and Lake Superior Company.

MAYOR AGAINST MUNICIPALISM.—In opposing a plan for the purchase by the city of the Williamsburg ferries on the East River, this week, Mayor McClellan said: "For my part, I am not, as a general proposition, in favor of committing the city to the operation of ferries at a loss. I look upon municipal operation as a last desperate resort and something that should not be resorted to until all other resources have failed. For that reason, while we were obliged to take over the Staten Island and Thirty-ninth Street Ferries, I do not look favorably upon taking over other ferry properties."

BRITISH PATENT ACT.—The British Comptroller General of Patents has revoked a patent owned by the British Westinghouse Electric Manufacturing Company relating to arc lamps. It was held that while 1308 arc lamps covered by the patent were manufactured at Trafford Park up to October, 1908, a German company to which the Westinghouse granted a license exported between 1906 and 1908, 9856 lamps, and the Comptroller decided that on evidence before him he is satisfied that the patented article is not manufactured to an adequate extent in the United Kingdom. Subject to an appeal to court, he therefore revoked the patent and ordered the patentees to pay to the applicant the sum of 75 guineas in respect of his costs.

ELECTROCHEMICAL SOCIETY.—The New York section of the American Electrochemical Society held a meeting at the Chemists' Club on March 1, at which time papers were presented by Dr. F. K. Cameron, of the U. S. Department of Agriculture, and by Dr. L. H. Baekeland. Dr. Cameron described a slide-wire bridge for measuring the resistance of moist soils and thereby determining the character of the soils. Dr. Baekeland explained in detail the process of manufacture of numerous articles containing "bakelite," which he exhibited. Bakelite is a coal-tar product, claimed to possess the properties of amber, rubber and celluloid, which can be used as an impregnating material for insulating purposes.

PROPOSED CHANGE IN FRENCH PATENT LAW.—The principal provision of the bill introduced by the French government to amend its patent law provides that patent rights shall be held to lapse in the event of failure on the part of the holder either to exercise his right in France or in the French colonies for a period of three years after applying for his certificate, or to resume exercise of after a similar interval; or, secondly, in the event of only partial exercise of the patent in French territory. In the second event the patent courts will be invested with discretionary power to call upon the holder of the patent to show cause why he should not exercise his rights in French territory "in an adequate degree."

MICHIGAN WATER-POWER REQUIREMENT.—The water-power investigation committee of the Michigan Legislature, which has been looking into the granting of a franchise to the Eastern Water Power Company on the Au Sable River, has advised the supervisors of Oscoda County that they should reduce from five to two and a half years the time within which the company may begin work of development and should increase the price of the franchise, which was fixed at $100 by the board of supervisors, and should require the power company to furnish a bond that the proposed dams will be built; that a concession in rates should be made to the people of Oscoda County at distant points supplied by transmission lines, and that the entire franchise proposition should be submitted to the people at the April election.

VICTORIA FALLS POWER.—At a recent meeting of the Victoria Falls Power Company in London the name of that company was changed to the Victoria Falls & Transvaal Power Company, Ltd. It was stated that while when the company was promoted one of its objects was to generate power at Victoria Falls for transmission to Johannesburg it has not been possible up to the present time to obtain the permission of the Transvaal government to run transmission lines from the Rhodesian border to Johannesburg. Another portion of the scheme was to construct new steam stations on the Witwatersrand and also to work stations that had been purchased. One of the latter has had its capacity increased by 8000 hp and a new station of 16,000 hp is under construction. During 1907 the profits of the company were $180,000 and the profits of last year were practically the same.

MESSAGES FROM MARS.—The wireless telegraph operators at Mount Wilson, Cal., state that they have recently been receiving signals in some curious code that is neither Morse nor Continental nor anything else legible. These signals are quite strong, and the operators have been conjecturing that they may come from Mars. Mr. Nikola Tesla writes us on this surmise: "I do not believe that the operators are observing the same disturbances which I have already noted in Colorado, because I had to use a device of wonderful sensitiveness, which I have reason to believe is not yet known to the wireless people. I rather think it is likely that a plant somewhere is producing stationary waves; and I have an idea that it must be located in Japan, as the Japanese experts saw me during 1900 and adopted my system at that time. Should the reports continue, I shall make an investigation. It will not be difficult if such is the case to locate the transmitting plant very closely."

FREAK LEGISLATION.—A bill recently introduced in the New York State Legislature provides that "insulators made of glass distinctly red in color" shall, for better security to life, be used in pole-line construction.

MINNESOTA CONVENTION.—The convention of the Minnesota Electrical Association is to be held at the Nicollet Hotel, Minneapolis, March 18 and 19, in accordance with the program published in the *Electrical World* of Jan. 21. The first session is to be held at 9:30 a. m., March 18. The secretary is Mr. Ludwig Kemper, of Albert Lea, Minn. The program prepared is an attractive one for the practical central-station operator.

WIRELESS COMMUNICATION WITH AERIAL CRAFT.—According to a Boston dispatch Mr. Chas. J. Glidden is having powerful wireless apparatus installed in his apartments in that city for the purpose, it is said, of communicating with any aerial craft carrying wireless equipment that may be flying east of the Mississippi River. He proposes to use a balloon equipment as part of the system.

MASSACHUSETTS PROPOSED RATE REGULATION.—A hearing was given by the committee on public lighting of the Massachusetts Legislature on Feb. 26 on a bill to permit the Board of Gas and Electric Light Commissioners to examine the returns of electric and gas lighting companies with special reference to their bearing upon the rates in force, and to give the board power to initiate investigations as to whether the prices charged are discriminatory or excessive. Attorneys Burdett and Pillsbury for the central stations in Massachusetts opposed the bill on the ground that it is unnecessary.

NEW YORK SECTION I. E. S.—The next regular meeting of the New York section of the Illuminating Engineering Society will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Thursday, March 18, at 8:15 p. m. The date is one week later than the usual time set apart for the meeting. Two papers will be presented—namely, "The Mathematical Theory of Finite Surface Light Sources," by Mr. Bassett Jones, Jr., and "Illuminating the Editorial Offices of the New York *World*," by Mr. Albert J. Marshall. These papers treat both the theoretical and the practical sides of illumination.

BOSTON EDUCATIONAL NOTES.—The Electrical Engineering Society of the Massachusetts Institute of Technology recently held a dinner at which the principal speaker was Mr. L. L. Elden, electrical superintendent of the Edison Electric Illuminating Company of Boston. Mr. Elden addressed the society on the work of the Edison company, with special consideration of the generating and distributing systems. The lecture was extensively illustrated by lantern slides. At a meeting of the Mechanical Engineering Society of the Massachusetts Institute of Technology, on the evening of Feb. 25, Mr. H. L. Coburn, of the Ambursen Hydraulic Construction Company, Boston, gave a lecture on hydro-electric plants. Prof. Charles E. Lucke, of Columbia University, gave a lecture in Boston on Saturday evening, Feb. 27, before the Society of Arts of the Massachusetts Institute of Technology on the history and development of the gas engine.

ELECTRIFICATION OF GERMAN RAILROADS.—In a report to the United States Bureau of Manufactures, Consul Thomas H. Norton, writing from Chemnitz, gives some data relative to the cost of equipping German railroads electrically. On the basis of calculation made by Ph. Pforr, it was estimated that steam locomotives cost about $0.1186 per pound, as compared with $0.1834 for the electric competitor. The latter is, however, relatively much lighter. A 600-hp electric freight locomotive weighs 92,593 lb. The usual types of steam locomotives of the same power weigh 125,400 lb. empty, and 167,000 lb. when charged with water, etc. On the basis of replacing 64 per cent of the present stock by electric locomotives the entire railway systems would require an outlay of $133,750,000 for electric locomotives to replace the present supply of steam locomotives, which cost $167,000,000. The opinion was expressed that in the early future electricity will displace steam entirely or in great part on all of the leading German lines.

INDIANA TELEPHONE LEGISLATION.—Indiana independent telephone interests are urging the passage of the Wells bill to enable one telephone company operating under an Indiana charter to take over by lease or purchase another company operating under similar conditions, as being the best means for successfully contesting the inroads of the Bell company and preventing the ultimate establishment of one system throughout the State. Under the present law one independent company cannot sell its stock to another, and under such limitations the Bell becomes the only logical purchaser of small companies whose managements have not been successful. It is contended that if the independents are given the right to merge, the strong companies will take over the small companies and strengthen the independent system throughout the State and thus be on an equal footing with the Bell, which operates under a foreign corporation charter. Representative Weekey has introduced a bill which, it is claimed, would compel all telephone companies operating in the same territory to make physical connection of their exchanges.

EDISON ON EDUCATION.—In an article in the Yale *News,* Mr. Thomas A. Edison expresses the opinion that a college education is decidedly not essential as a preparation for a young man about to enter upon a scientific career. He believes that the purely academic training is a great waste of time, since in four years no one can learn all the essential points of science, and four years of active experimental work will be of much greater value than an equal amount of time spent in obtaining a college education, in spite of the fact that the minds of college men are better trained, and therefore obtain further learning more easily. He adds that what the country needs now are engineers, industrial men, good business managers and railroad men, though in three or four hundred years, when the country is settled and commercialism is diminished, there will be time for literary men. His greatest objection to a college education for a scientist is that academic learning is old and does not keep progress with the times; if colleges could teach their men to become first-class draftsmen, that would be a great advance, for skilful drafting implies that a man can do anything.

THE PUBLIC AND THE ELECTRIC SUPPLY COMPANIES.—In giving a report of the company's recent work, the chairman of the London Electric Supply Corporation, the Earl of Crawford, stated that the history of the treatment of the electrical industry in London is a curious episode in the attitude of popular government toward money-making. The popular agitation in England has been against the London electric companies as if they were making too much money and blocked the way. He remarked that "More business sense, as Mr. Carnegie calls it, now prevails. The idea is exploded that cheap power can be made by act of Parliament, and that if the electrical companies pay big dividends it necessarily means dear power and the consumers' loss. I hope and think that, by the act passed during the last autumn session, the policy of taking care of the consumer at the expense of the producer is abandoned in the electrical industry once for all, and that we shall henceforth be free to make fair dividends till 1931, and then hand over a group of prosperous undertakings to the London County Council without any loss of capital being inflicted on our shareholders." The report showed that the corporation had sold last year 3,000,000 kw-hours more than the year before; the extra cost for production, however, was increased by only $3,440 on account of various improvements in equipment and operating methods.

Building and Boiler Plant of Waterside Station No. 2 of the New York Edison Company.

THE utter impossibility of foretelling what advance will be made in the electrical art and how soon existing machinery will be displaced by more efficient apparatus, or of even predicting at what rate the load in a large and progressive city will increase, is well illustrated in the case of the New York Edison Company. When, in October, 1901, Wateside Station No. 1 began to feed electrical energy into the network of the Edison company, with its initial generating capacity of 32,000 kw, it was felt that after all of the apparatus was installed and the station was capable of generating over 64,000 kw, there would be an ample supply of electricity for many years to come. The thought perished, however, before the station was in operation more than three years. So rapidly did the load increase that a newer and larger Waterside had to be erected and placed in operation just as soon as the machinery could be turned out.

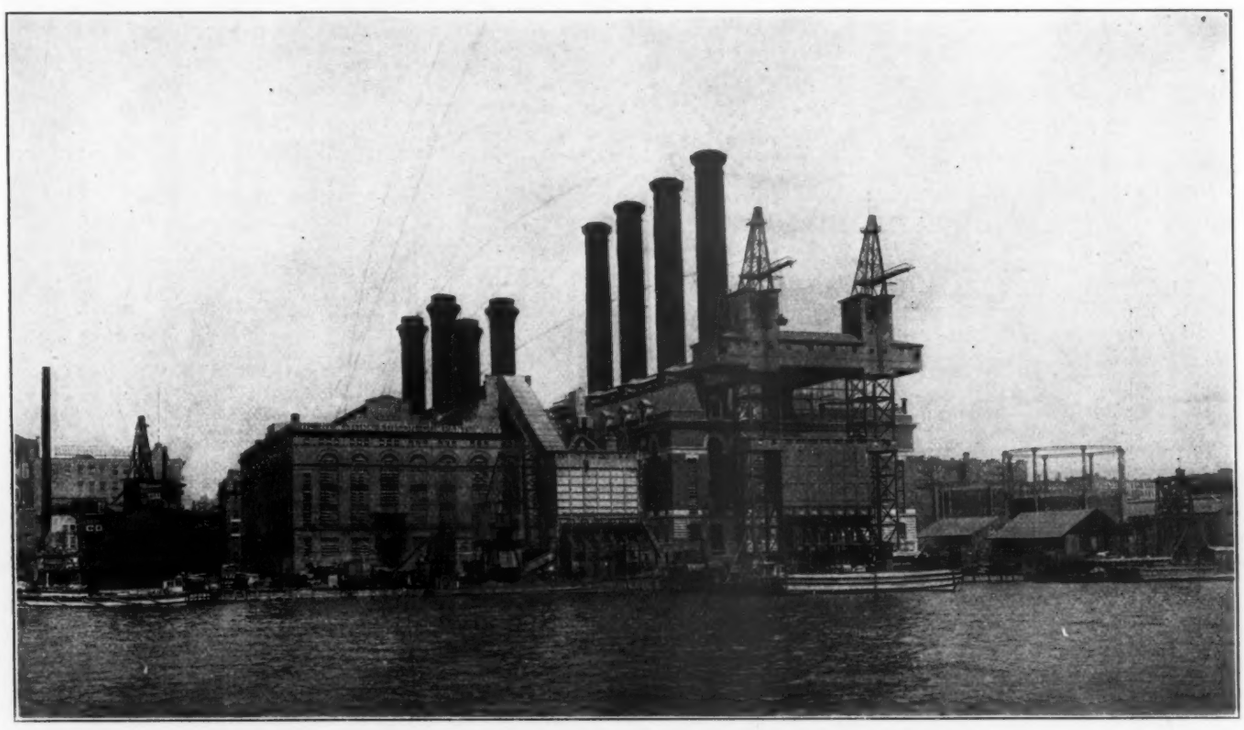


FIG. 1.—WATERSIDE STATIONS OF THE NEW YORK EDISON COMPANY HAVING AN AGGREGATE MAXIMUM RATING OF 330,000 HP.

The advance made in the art is strikingly illustrated in the engravings showing the generator rooms of both stations. Here is a remarkable example of the evolution in power-plant practice resulting from the perfection of the steam turbine as a prime mover. When the first Waterside station was designed, the steam turbine had scarcely been considered in units of large capacity; but its development was so rapid and so successful that before all the generating apparatus in Waterside No. 1 had been installed, the advantages of the steam turbine were sufficiently apparent to warrant the installation of turbines instead of the last few engine-driven units as originally intended. Even in the design of Waterside Station No. 2 it was thought advisable to provide for either vertical reciprocating engines, or for either or both types of steam turbine units of the maximum size then developed; thus necessitating a compromise between the demands of the various designs. The operating room was laid out to contain 12 6000-kw vertical, engine-driven units or 16 5000-kw vertical turbine units, or 12 5500-kw horizontal turbine units. Further developments in the turbine field and certain operating conditions have determined the final layout.

Waterside Station No. 2 was placed in operation in November, 1906, and the last unit was installed in Waterside Station No. 1 in 1907. The difference in the design of both stations may be briefly summarized as follows: Waterside Station No. 1 was originally designed for 16 3500-kw engine-driven units. The equipment actually installed consists of 11 3500-kw vertical steam-engine-driven units, three 10,000-kw and two 5000-kw vertical turbine units. The boiler room contains 56 water-tube boilers, 19 of which are fitted with inclined-grate stokers and 8 with superheaters. Thirty-seven of the boilers are fitted with flat grates for burning buckwheat No. 3 coal. The grates are 9½ ft. deep and 12 ft. 7 in. wide. The boilers are arranged in two double-decked rows, one on each side of the boiler room, 14 in a row, or 28 on a side. Eight of the boilers are equipped with superheaters. Coal is received on a tower hoist with duplicate bucket conveyor for distributing the fuel to bunkers holding 12,000 tons. The ashes are dumped into hand-operated cars and are elevated by a skip hoist for final disposition. Reciprocating feed-water pumps are used, and closed feed-water heaters, primary heaters being inserted in the engine exhaust and secondary heaters in the boiler feed lines. The auxiliaries are all steam-driven and surface condensers are used on all the apparatus in the generator room. Waterside No. 2 at present contains six 8000-kw vertical turbo-generators, two 7500-kw horizontal turbine units, one 14,000-kw vertical unit and another 14,000-kw vertical unit is about to be installed, completing the equipment of the station. Surface condensing equipment is used on these units. The circulating pumps on eight of the condensers are centrifugal, engine-driven, and on two are turbine-driven. There are four reciprocating and six turbine-driven centrifugal hot-well pumps. Rotative dry-vacuum pumps are employed on all the condensing apparatus. Open feed-water heaters are used throughout. The boiler room contains 96 water-tube boilers rated at 650 hp. The boilers are fitted with superheaters and are arranged upon the cross-fire room plan. Twenty-four of them have 10-ft. shaking grates, 13 are fitted with underfeed stokers, five are not yet equipped, and the rest have 12-ft. grates.

Fifty-four of the boiler furnaces have arches and the 24 boilers fitted with 10-ft. grates have no arches. The same fuel is used as in the other station. Instead of a bucket conveyor the fuel is delivered to the bins in cable-drawn dumping cars. The ashes are removed in cars which are pulled by electric locomotives equipped with storage batteries. A bucket-conveyor is at present used to hoist the ashes to the storage bin, but a skip hoist, now in course of erection, will supersede this arrangement and the bucket conveyor will be held as a reserve.

THE BUILDING.

Waterside Station No. 2 is erected at First Avenue, Thirty-ninth and Fortieth Streets and the East River immediately adjoining Waterside Station No. 1. Fig. 1 shows both stations from the river, and Fig. 4 is a front view. The building occupies a trapezoidal plot fronting on First Avenue for a distance of 197½ ft., extending back on Fortieth Street a distance of 347 ft. 2 in., and on Thirty-ninth Street a distance of 336 ft. 1⅞ in. The structure is divided into two parts—an engine room 73 ft. 10 in. wide and a boiler room 119 ft. 8 in. wide, the dividing line being parallel to Thirty-ninth and Fortieth Streets. Architecturally, the building is somewhat more ornate and pleasing in appearance than the older station. A base of granite extends to the height of the second story, above which rise red brick walls surmounted by a terra-cotta cornice. All the wall and dormer window trimmings are of terra cotta, while the roof monitors have a copper finish. The roof of the boiler house is covered with Spanish roll tile on the mansard portion, while all flat sections of the turbine and boiler room roofs are of cinder concrete construction, covered by flat tiles. A feature of the exterior is the window treatment, the windows being surmounted by a terra-cotta arch which rises from the entablature of terra cotta surrounding the structure. The window in the First Avenue end of the turbine room received special treatment with a very pleasing result and is surmounted by a terra-cotta setting bearing the name of the company.

The structure is fireproof throughout. Brick and concrete have been used in connection with the steel skeleton. The boiler room and turbine room floors are of very heavy construction, designed for uniform loads up to 600 lb. per square inch. In addition the structure carries on the boiler-room side five large bins capable of holding 20,000 tons of coal. The bins are of reinforced concrete construction with vertical stiffeners of I-beams embedded at intervals. The roof structure above

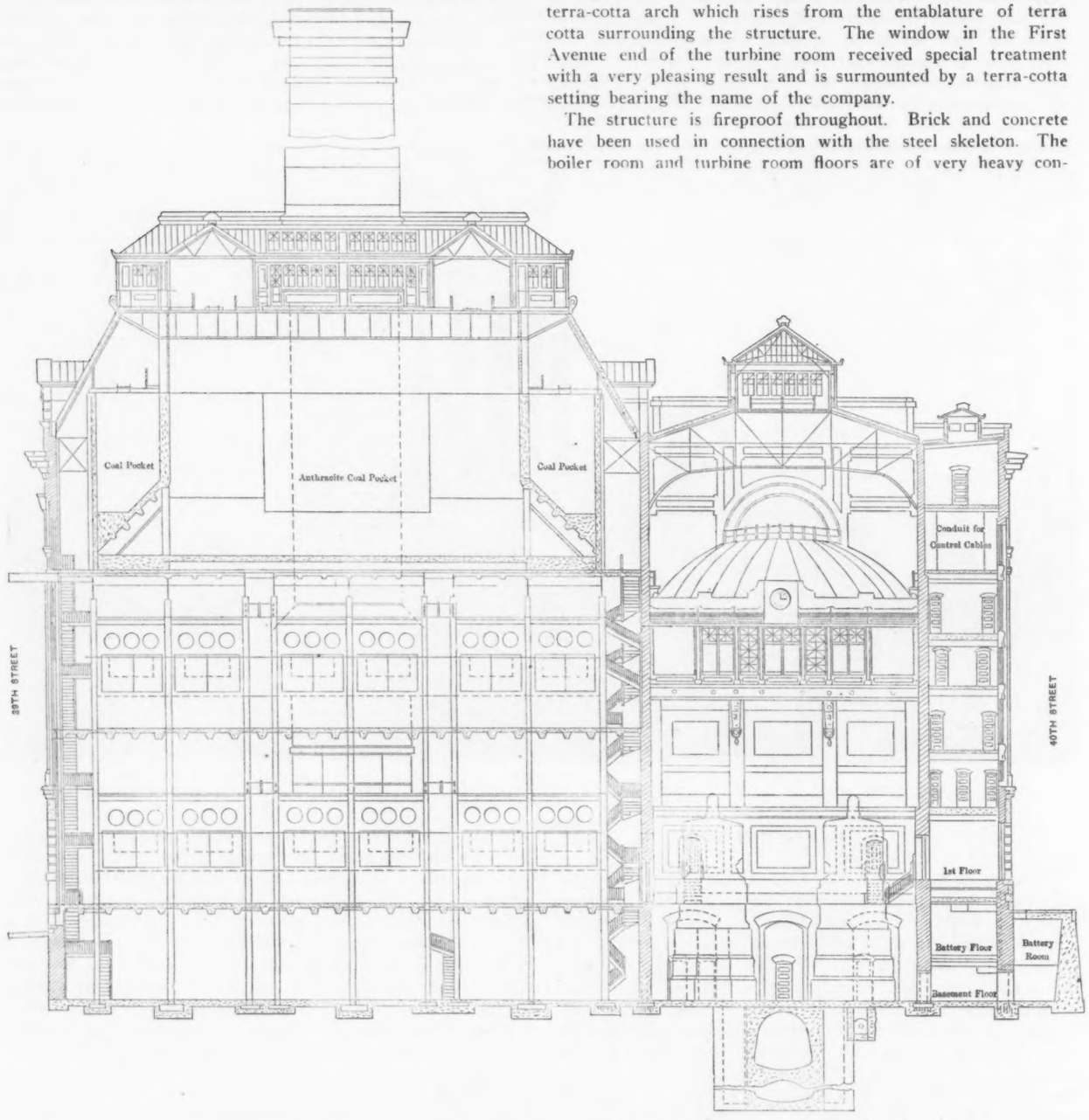


FIG. 2.—ELEVATION OF WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY.

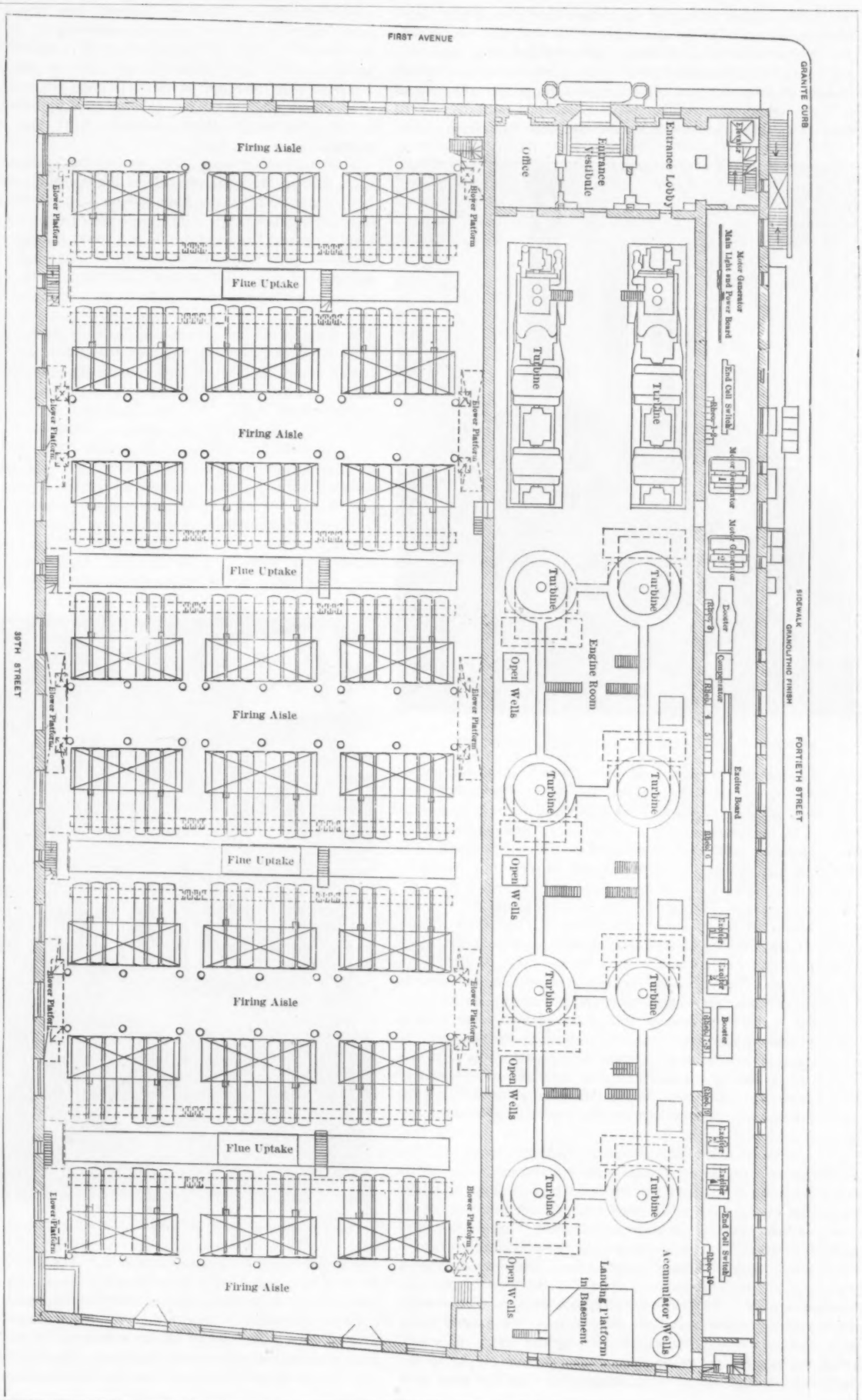


FIG. 3.—PLAN VIEW OF WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY. DESIGNED FOR AN ULTIMATE MAXIMUM EQUIPMENT OF 200,000 HP.

the turbine room is carried by trusses having a 57½-ft. span surmounted by a 20-ft. monitor for lighting and ventilation. The boiler-room roof, monitors and coal-handling apparatus are carried by a series of 72-in. plate girders and 15-ft. Pratt trusses, all of 90-ft. span. In the turbine room are a 50-ton and a 75-ton crane, with a span between runway rails of 52½ ft. For the circulation water inlet and discharge tunnels, a trench

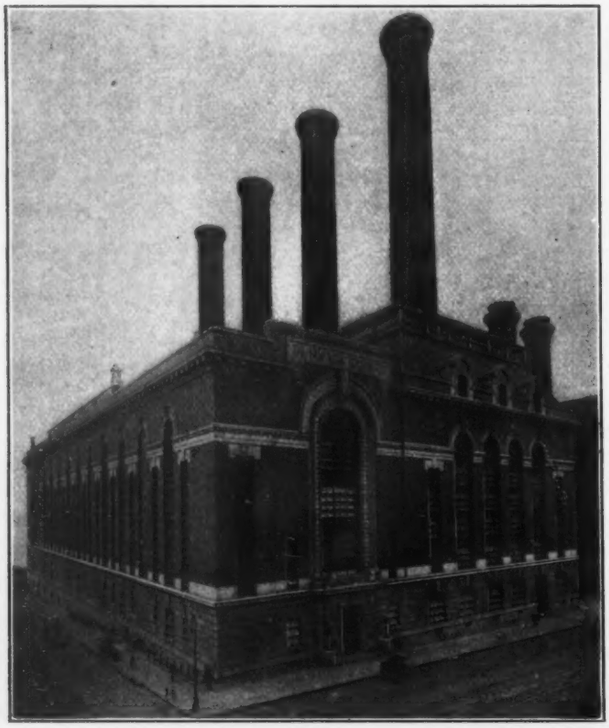


FIG. 4.—EXTERIOR VIEW OF WATERSIDE STATION NO. 2.

approximately 35 ft. wide and 30 ft. deep was blasted out of the rock upon which the station was built. The boiler-room basement is 20 ft. high, and the boiler-room floors are 36 ft. and 34 ft. high, respectively. Above this a space about 50 ft. high, up to the roof level, is occupied by the coal bunkers. The coal-handling system is accommodated in the roof monitors. The turbine section has a 25-ft. basement, in which the condensing apparatus is placed. The turbine room itself has a clear height of 88 ft. under roof trusses. The group of galleries at the Fortieth Street side of this room consists of six mezzanine galleries above the main floor for the switching apparatus and a basement gallery for a substation and reserve exciter storage-battery equipment. A system of galleries is provided at the First Avenue end of the turbine room for the accommodation of offices for the station operatives and the electrical and mechanical construction departments. At the top, surmounted by a glass dome, is the main station switchboard and control board. From this gallery the entire electrical equipment of the station is under supervision and control.

The interior finish of the station is worthy of mention. The entire exposed surfaces of the walls of the operating room, from the level 25 ft. above the finished basement floor up to the underside of the roof arches, and the exposed surfaces of the walls enclosing the high-tension switchboard room on the third mezzanine floor at the westerly end of the operating room, are fitted with "Grueby" glazed faience tile. The wainscoting or base from the operating-room floor up to the level of the first mezzanine floor is built out 8 in. beyond the face of the walls above and two shades of green tile are used; the ground being of a dark shade and the panels of a lighter shade of green. From the space between the top of the wainscoting up to the underside of the crane girders, the ground is of flat gray with panels of purple. The space between the top of the cornice under the crane girders up to the underside of the roof arches is finished in white tile. The pilasters, pediments, architraves and the continuous ornamented cornice under the crane girders for both sides and end of the operating room are finished in gray glazed faience. The walls of the high-tension switchboard room, on the third mezzanine floor, have a white tile ground.

The exposed surfaces of the wall of the exciter room on the main floor at the northerly side of the operating room, the surface of the walls of the stair hall on each of the six electrical mezzanine galleries, including the walls of the stair halls on the main floor and battery-room floor level at the easterly end; the surfaces of the four walls enclosing the stair and elevator halls on each of the six northerly electrical mezzanine galleries at the westerly end, and also from the mezzanine battery-floor level up to the main floor, are finished in white enamel brick. The surfaces of the inside of the walls enclosing the high-tension galleries on the first, second, third and fourth mezzanine floors, the control pipe runway room on the sixth mezzanine gallery and the oil-switch structure are of shale buff vitrified brick.

The flooring of the main entrance vestibule, entrance lobby and the stair and elevator hall on the main floor under the westerly mezzanine galleries is finished in white marble mosaic with a decorative border of colored marble mosaic of a Greek fret design. A seal or monogram of the company, about 30 in. in diameter, executed in colored mosaic is placed in the center of the floor of the lobby. The surface of the walls, columns, pilasters and piers, and the door and window jambs and trim and room bases of the vestibule, entrance lobby and the stair

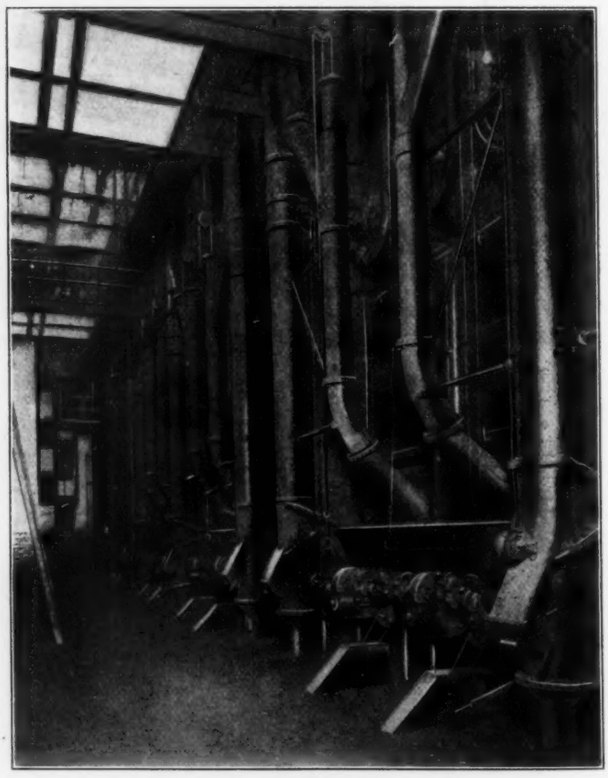


FIG. 5.—AISLE OF BOILERS EQUIPPED WITH STOKERS.

and elevator hall are finished in marble. The entire area of the floor of the high-tension switchboard room, on the third mezzanine floor, is covered with an interlocking rubber tile.

From the above it is evident that much thought has been given to make the interior of the station as finished in appearance as any high-class office building. The scheme has been well executed, with the result that the traditional power house

with its dirty walls and oily floors is as different from Waterside No. 2 as a hut is from a palace.

COAL- AND ASH-HANDLING APPARATUS.

The 96 boilers in the station will require at period of maximum demand an average of 150 tons of hard coal per hour, which is delivered to them from steel and concrete bunkers over 80 ft. above the ground. Five bunkers extend across the full width of the building and alternate with the four smokestacks on the same horizontal center line. The three intermediate bunkers have a single large bin holding 5000 tons of hard coal without trimming and two small side bins have a capacity of 300 tons of coal. The end bunkers contain approximately 3200 tons of coal, giving a total storage capacity of about 20,000 tons. The bituminous coal is delivered in boat-load lots of about 800 tons each, and the small quantity for which storage is provided is used chiefly in the stokers and for mixing with the buckwheat coal used in the hand-fired boilers.

The bunkers are filled by 3-ton automatic dump cars traveling in a continuous circuit on loop tracks that provide two lines parallel to the axis of the building and extend beyond the power house to the top of the coal tower. The tracks are near the center line of the building, are about 120 ft. above ground and are carried from the river end of the building to the hoisting tower on a deck-plate girder bridge having a span of about 90 ft. The original plan called for soft-coal tracks at a level of about 16 ft. below the upper tracks and nearer the outer walls of the building, making a complete circuit independent of the tracks above, but the latter tracks were not installed. Soft coal is delivered on the same tracks as the anthracite coal and dumped in the bins at the front end of the building. Two hand-operated distributors receive the soft coal as it drops from the cars overhead and direct it to various parts of the front bin so that the bunker is well trimmed. At present the semi-bituminous coal used with the anthracite coal in the hand-fired boilers is brought to the boilers in barrows and mixed in the proportion of 20 per cent bituminous with 80 per cent buckwheat by the fireman. It is proposed to effect this mixing in the bins overhead by unloading soft coal and hard coal at the same time and timing the cars so that four cars of anthracite will dump over each car of semi-bituminous coal. Intimate mixture is not required, so that the plan should give the desired result.

It was originally intended to unload the coal boats with clam-shell buckets hoisted about 90 ft. and discharged into a receiving hopper, from which the coal would pass through a crusher to be delivered to the horizontal arm of a continuous bucket-conveyor system connecting both sides of the tower and elevating the coal to the distributing tracks, 160 ft. above low water. Here the coal would be discharged into an eight-ton hopper and thence into distributing cars on a scale platform. It was deemed advisable to avoid the use of conveyors for this purpose, and the height of the towers was increased to a total of about 240 ft., enabling the coal to be hoisted by the clam-shell buckets at one operation to the maximum height. The hoist of about 180 ft. is believed to be the highest of its kind that has yet been attempted, and each of the two 1½-yd. buckets is calculated to make two trips per minute, thus giving a total capacity of 360 tons per hour.

The buckets are suspended from a trolley running on a horizontal arm of the stationary jib, about 40 ft. long, and operated by a Rawson & Morrison hoisting engine with two drums, one for lifting and the other for closing. The bucket is traversed by a trolley engine on the main engine frame and is steadied by a counterweight suspended from the end of the boom. The fuel is discharged into receiving hoppers, from which the semi-bituminous coal passes by gravity through a steam-driven crusher to a second storage hopper of about 10 tons capacity, provided with a bottom cut-off valve by which the coal is loaded into W-shaped side-dump cars standing on the scale platform and hauled by an endless cable across the bridge to the power house. Anthracite coal is handled the same way except that it is not passed through a crusher. There are two duplicate independent hoists at opposite ends of the tower, and in order to enable the tracks to pass under the crusher, the track floor is extended outside the tower columns and supported on heavy cantilever girders.

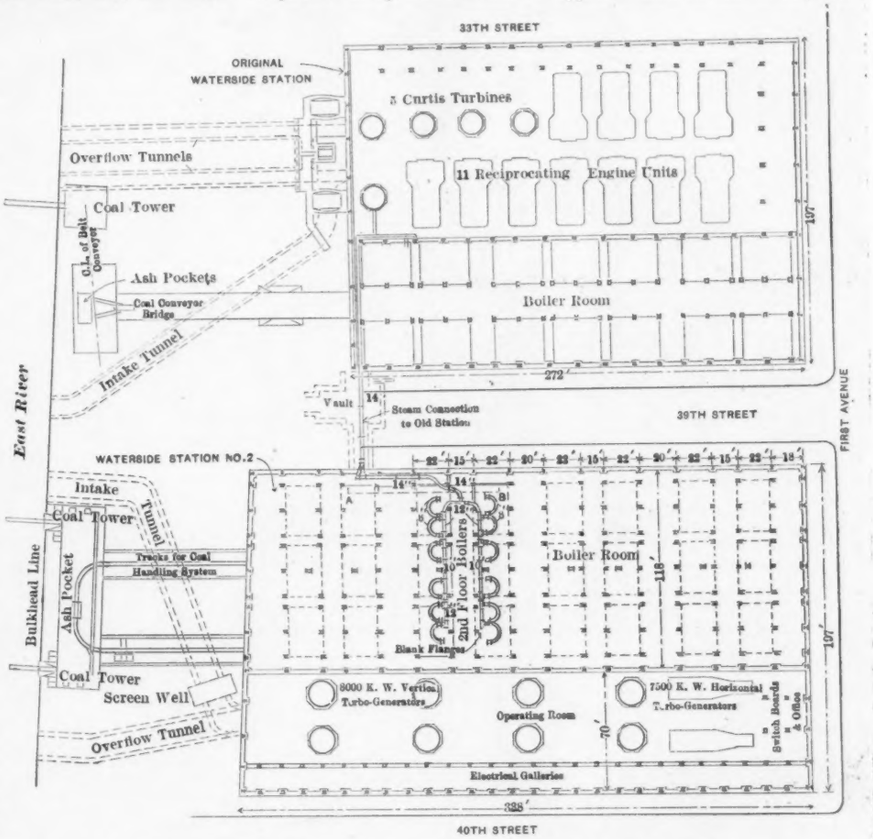


FIG. 6.—PLAN VIEW OF WATERSIDE STATIONS OF THE NEW YORK EDISON COMPANY.

The tower has a steel framework about 240 ft. high, 110 ft. long and 25 ft. wide, which really consists of two 25 ft. x 25 ft. twin towers 240 ft. high and 80 ft. apart between centers, connected by an ash bin at a clear height of 40 ft. above high water and by the track platform at a height of 140 ft. above the water. Each of the twin towers is built with four vertical columns about 160 ft. high, divided into seven stories by longitudinal and transverse horizontal struts with bracing diagonals in the panels between them. Above the tops of the vertical posts, the towers have extensions with two vertical and two horizontal columns in each. The track floor is enclosed by a house about 25 ft. high and 140 ft. long, with extensions 20 ft. higher enclosing the bases of each of the pyramidal tops. The ash bin has a total height of about 60 ft., and is closed on all sides. Between the bin and the track floor the vertical space of about 45 ft. is occupied by a skeleton steel framework for an electric sign. No other portions of the structure are enclosed. The ash bin is supplied with exhaust steam to heat the wet ashes and prevent them from freezing in cold weather. The ash

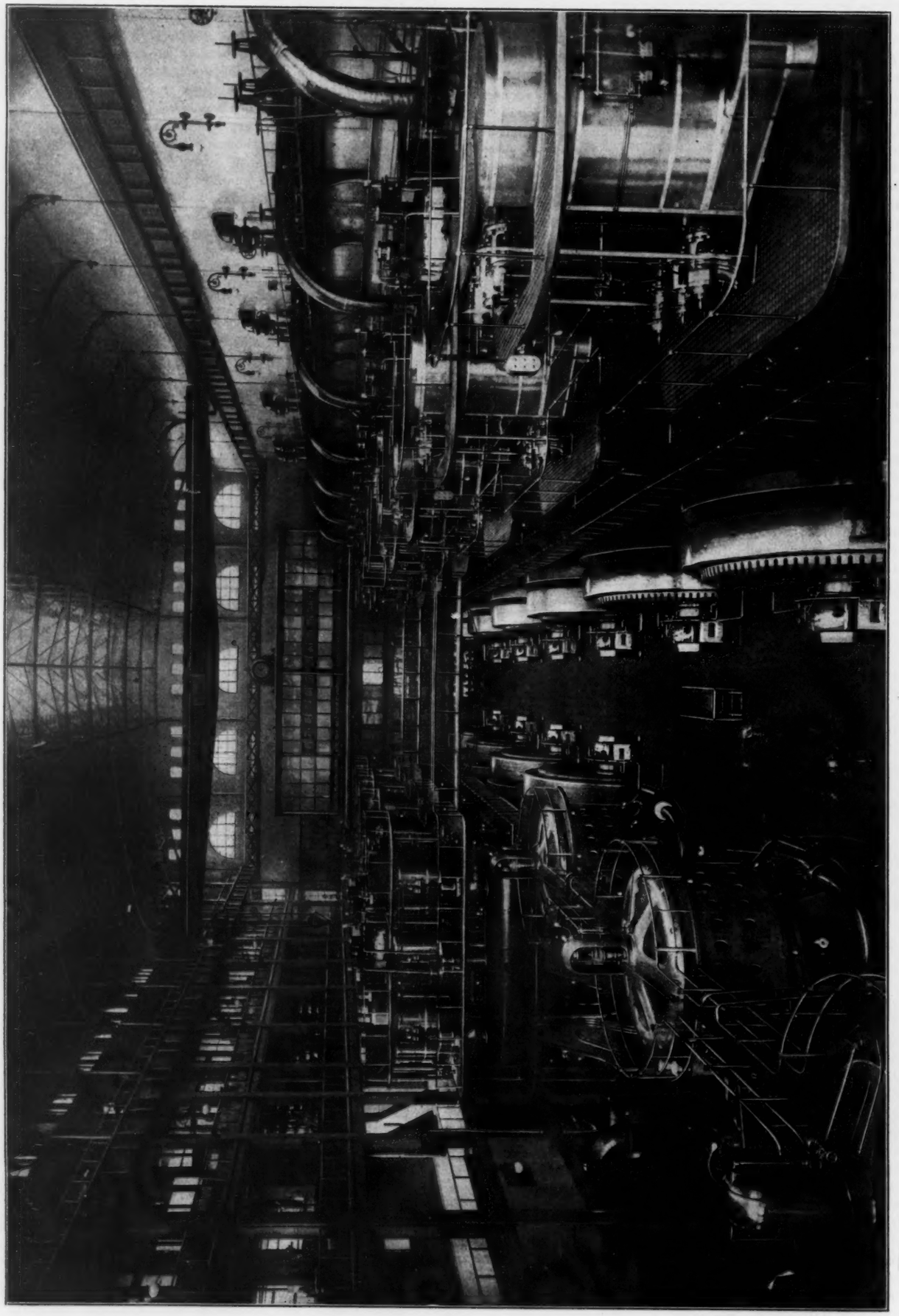


FIG. 7.—GENERATOR ROOM OF WATERSIDE STATION NO. 1, PLACED IN OPERATION IN 1901 AND HAVING A MAXIMUM RATING OF 130,000

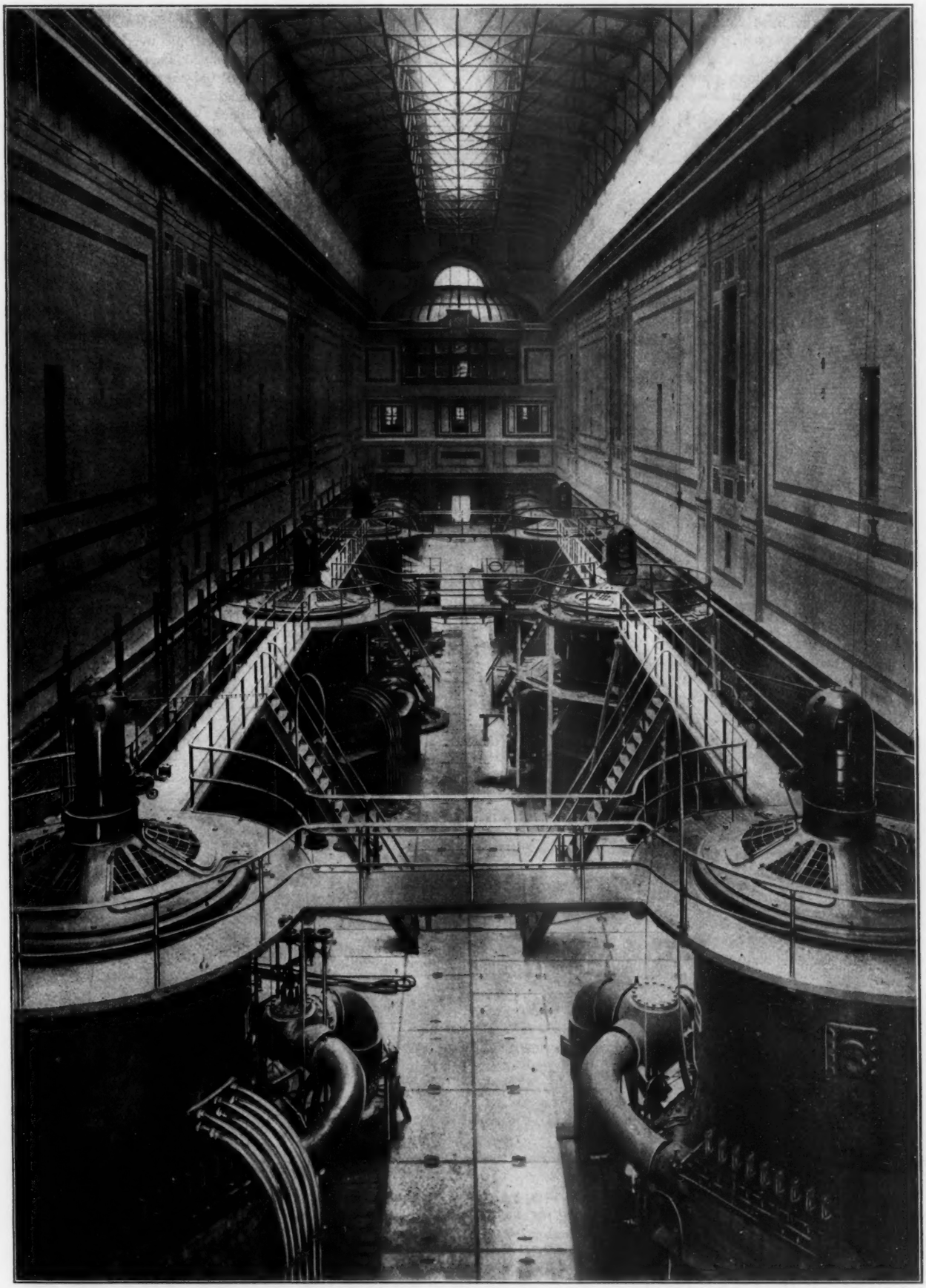


FIG. 8.—GENERATOR ROOM OF WATERSIDE STATION NO. 2, PLACED IN OPERATION IN 1906 AND DESIGNED FOR A MAXIMUM EQUIPMENT OF 200,000 HP.

bin holds approximately 1000 tons. It is fitted with a double set of very large fixed chutes commanded by vertical sliding gates that enable the ashes to be delivered to barges moored alongside the dock or to wagons on the street.

The bin is of very simple construction, with vertical end and side walls and a bottom inclined about 45 deg. downward toward the river. The walls and bottom of the bin are lined with concrete arches. In each panel of the floor a scupper nearly 3 ft. square is provided with connection to a fixed rectangular steel chute about 2 ft. square made of ¼-in. steel plate. The chutes are about 40 ft. long over all and have steep inclines so as to insure free discharge of the wet ashes. The lower end projects beyond the river face of the tower, and the bottom is bent vertical and is controlled by a cut-off valve through which the ashes are discharged into boats. Similar chutes are provided for discharging the ashes into carts under the tower. The bin has a flat concrete roof pitched toward the river. Two wooden platforms afford access to the mechanism for operating the chute valves.

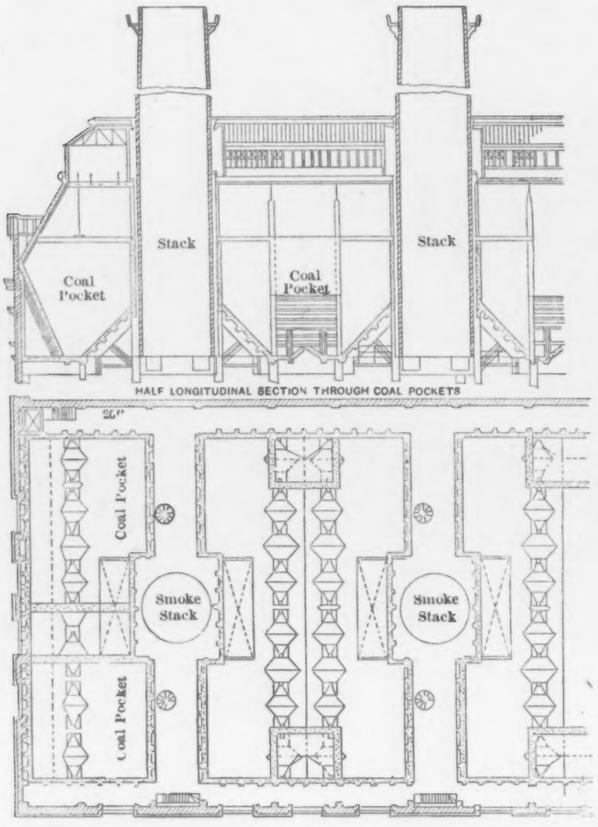


FIG. 9.—ARRANGEMENT OF COAL POCKETS.

All of the machinery in the tower is operated by steam, and the coal hoisting and conveying requires a total force of six men. The number required for handling the ashes is variable. The hoisting and lowering of each coal bucket is controlled by one man, and the traversing and dumping of it by a second man, both of whom watch the bucket continuously and do not rely upon signals. In order to provide an unimpeded view of the bucket for the hoisting operator, he is stationed in a projecting bay provided with side windows and a window in the floor through which he can view the deck of the coal boat; there are also provided at each end of the tower structure arc lamp projectors throwing a vertical beam of light for night operation.

The ashes are removed from the ash pits through chutes emptying into cars running on tracks beneath the ash hoppers. The cars are 6 ft. long and hold from 1½ cu. yd. to 2 cu. yd. They run on an industrial 2-ft. track with necessary switches, turnouts, etc., and are pulled by storage-battery locomotives operating at 80 volts. The locomotives are fitted with 44 cells of battery. Three are at present in use, one of which is kept in reserve. The ash conveyor is of the overlapping gravity-bucket type. The ashes are dumped from the cars into a hopper, as indicated in Fig. 13, and the conveyor discharges them into an ash pocket through a movable dumping block. The conveyor rises to the upper level of the ash pocket through the towers at the ends of the coal and ash structure and is provided with the necessary dumping mechanism, take-ups, drivers, guides, stops, etc. The entire coal- and ash-handling apparatus was installed by the Mead-Morrison Manufacturing Company, of New York City.

At present there is being erected a double skip hoist for disposing of the ashes. The ashes will dump from the cars inside the building into a loading hopper large enough to take two or three carloads of ashes so that it will not be necessary for the ash cars or locomotives to leave the building. The skip hoist will be operated by a 35-hp, 240-volt direct-current motor and will dump the ashes into the ash storage bin at present used. It is expected that by this means labor and maintenance costs can be reduced. The bucket conveyor will then be held in reserve.

BOILERS.

The boilers installed are all of the water-tube type, built by the Babcock & Wilcox Company. Each boiler is composed of 21 sections of 14 lap-welded charcoal-iron boiler tubes, each tube being 4 in. in diameter and 18 ft. long. The several sections are connected at each end to three 42-in. steam and water drums and at one end to a mud drum by means of 4-in. tubes. The steam and water drums are 22 ft. long and are connected to the back headers by vertical back-circulating tubes. The steel mud drums are 149 in. long and are provided with three hand-holes and two nozzles for blow-off connections. Each boiler is equipped with a superheater consisting of seamless steel U-shaped tubes expanded into forged-steel distributing and collecting headers. The superheaters are guaranteed to superheat the steam 100 deg. to 125 deg. above the temperature due to the pressure carried. Each boiler is rated at 650 hp, and is designed to deliver steam at 200-lb. pressure. The total heating surface is 6500 sq. ft.

FIG. 10.—COAL DISTRIBUTING CABLEWAY ABOVE BUNKERS.

Space is provided for 48 boilers on each boiler floor, or 96 boilers in all. There are upon each floor three main firing rooms, each having a row of three batteries of two boilers each on either side, and at either end of the building a half firing room with a single row of six boilers. This arrangement permits the use of four chimneys, each of which serves 24 boilers. Fig. 15

shows the details of the hand-fired boilers. All of the boilers are fitted with shaking grates, built by M. H. Treadwell & Company, Neemes Brothers and Washburn & Granger. The grates on 24 of the boilers are 10 ft. deep and 12 ft. 7 in. wide. The furnaces thus fitted have no arches. The other boilers, with the exception of those fitted with stokers, have grates 12 ft. deep and 12 ft. 7 in. wide. The grates are inclined toward the rear of the setting at a grade of 1½ in. to the foot, or a total of 18 in. in the deeper grates and 15 in. in the 10-ft. grates.

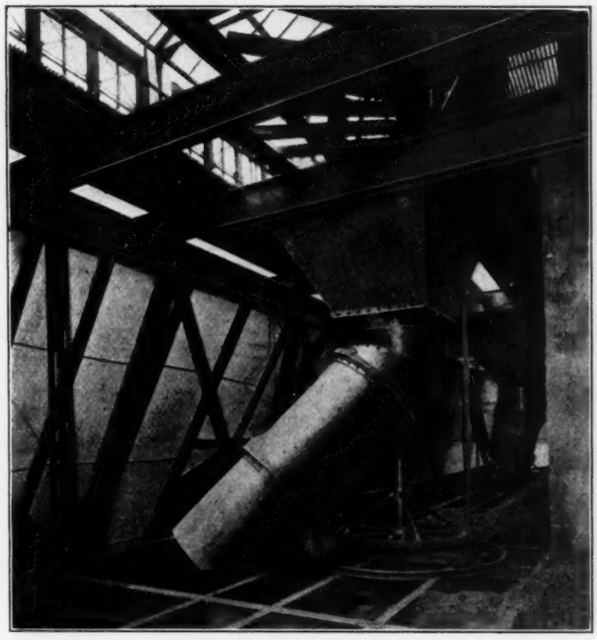


FIG. 11.—SCHEME FOR DISTRIBUTING SEMI-BITUMINOUS COAL.

Because of the depth of grate experiments were conducted to determine the type and height of fire door best suited for the conditions. As a result there are two sizes of door in use and these are set at three different heights. The smaller doors are 15 in. x 24 in., and are set 36 in. and 24 in. above the floor.

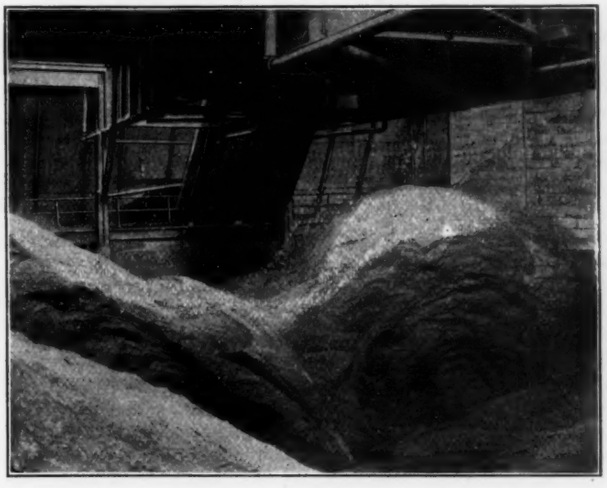


FIG. 12.—VIEW OF BUNKER FILLED WITH BUCKWHEAT COAL.

The larger door is 21 in. x 24 in., and is set 31 in. above the floor. With buckwheat No. 3 fuel and the depth of grate used, the latter size and height of door has given the best satisfaction. Thirty-six of the boilers are fitted with the larger doors. Two firemen are allotted to three boilers, and each of these fires about 11 to 15 tons of coal per eight-hour watch.

It is also found that the type of shovel used in throwing the coal bears an important relation to the efficiency of the firemen. With the deep grates, the angle of the shovel makes a great difference in the ease with which the fuel can be spread over the fire. The men normally hold the handle of the shovel horizontally and the angle the blade makes at that time determines the proper spreading of coal on the fuel bed. The shovel found to give best results has a handle 27 in. long. The angle is such that with the scoop resting level with the floor the end of the handle is 19 in. above the floor. Heretofore the handle was 25 in. above the floor. With a grate not so deep, so flat an angle would not be required. It is, of course, appreciated that a grate 12 ft. deep calls for a little more skill in firing than one 9 ft. deep. With the inclination of the grates adopted, the type of shovel and the height and size of the furnace door, the firemen in the station have no difficulty in keeping good fires under the boilers with all the grate surface covered.

FIG. 13.—VIEW OF ASH CONVEYING SYSTEM AT PRESENT IN USE.

FIG. 14.—AISLE OF HAND-FIRED BOILERS.

Twelve of the boilers, located on the First Avenue side of

the station, are fitted with underfeed stokers of the Taylor type, built by the American Ship Windlass Company, of Providence, R. I., and installed by the Lenher Engineering Company, of New York. No coking or ignition arches are used in the boilers thus equipped. The stoker consists of an inclined grate made up of air-perforated tuyeres, which are simple cast-iron plates laid up in steps. Between each row of tuyeres are two

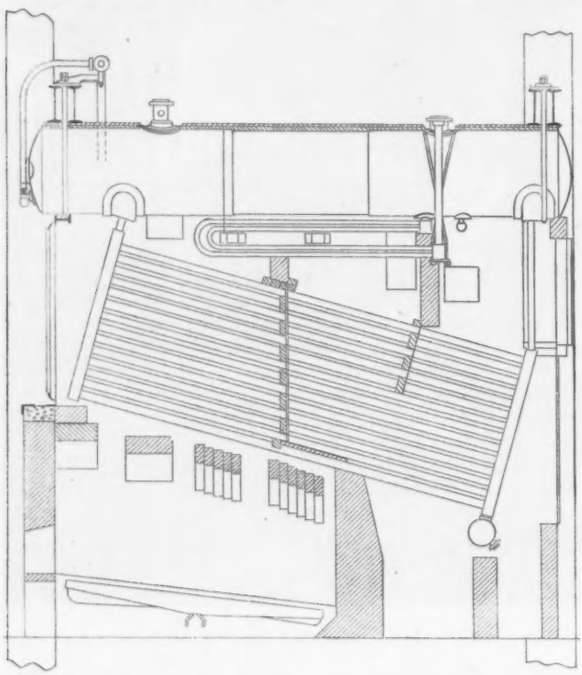


FIG. 15.—CROSS-SECTION OF BOILER WITH 12-FT. HAND-FIRED GRATE.

cylindrical rams, the upper ram receiving the coal from the hopper and the lower ram feeding only coal and partially consumed coke delivered from the upper ram. The two rams move in unison, the upper one deriving its motion from a geared crankshaft at the front of the hopper, and the lower ram from the connecting rod of the upper. The travel of the upper ram is fixed, being about 10 in., while that of the lower ram is adjustable to suit the conditions due to handling coals of varying ash

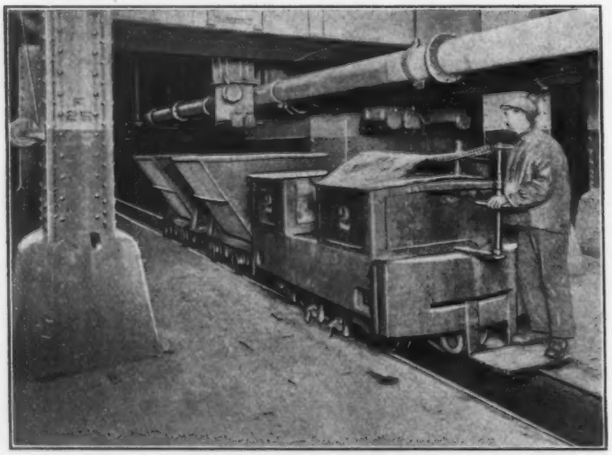


FIG. 16.—METHOD OF LOADING ASH CARS UNDER BOILER ROOM.

content. In practice the stroke of the lower ram is about 2 in. to 3 in.

The lower end of tuyeres rests on a rectangular box which acts as a support, and also as an air box, connecting all the tuyere rows to a common source of air supply. From the lower or back end of this box is hinged the segmental, sectional dump plates, operated by levers from the boiler front. This plate is unperforated, as combustion is supposed to be complete by the time that sufficient ash has accumulated to require dumping. The operation of the stoker is as follows: Coal is fed between the several rows of tuyeres from the hopper, meeting in its passage streams of heated air projected horizontally, these streams furnishing the air necessary for combustion. The

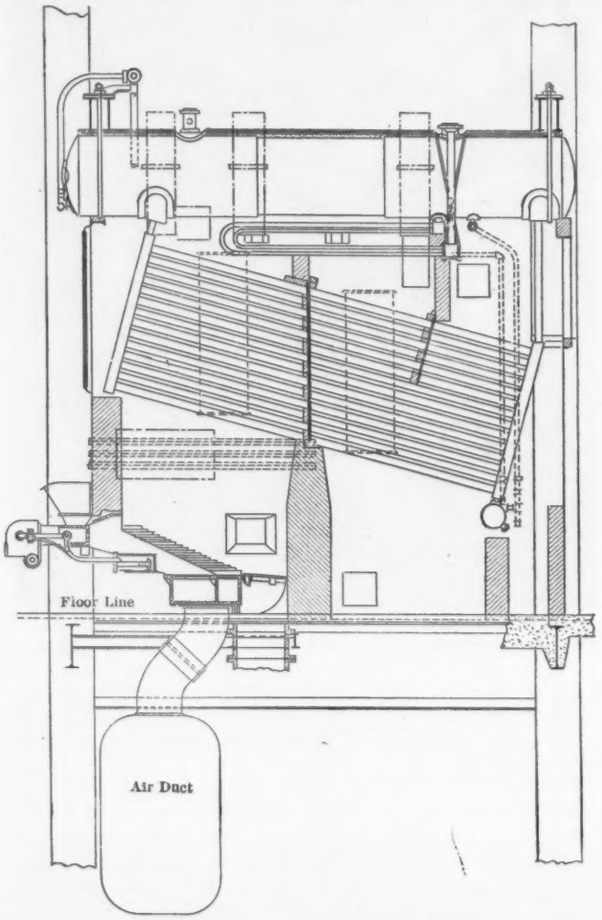


FIG. 17.—CROSS-SECTION OF BOILER EQUIPPED WITH STOKER.

resultant action of the two rams and gravity tends to break up the fuel bed continuously and move it downward toward the dump plates. The breaking action renders it unnecessary to slice or level the fire, the coal distribution being even, the only attention necessary being the periodical dumping of the ash. In practice these dumps take place in from three to five hours according to the fuel consumption. The coal feed is regulated by varying the speed of the engine driving the stoker mechanism. The air necessary for combustion is furnished by engine-driven fans of the multi-vane type, variations in thickness of fuel bed and rate of combustion requiring an air pressure equivalent to 2½ in. to 3 in. of water. In everyday practice these stoker-equipped boilers are operated at a rating giving the maximum efficiency of the combined boiler and furnace, the normal variations of load being met by the boilers equipped with hand-fired furnaces. There is, however, a large margin of capacity available in the stoker-equipped boilers to meet abnormal demand. Fig. 17 shows a sectional elevation of a boiler equipped with the stoker.

All furnaces are equipped with draft gages and all forced-blast air ducts have registering pressure gages of the Bristol type so that the proper pressure can be maintained. In the hand-fired boilers a pressure of 0.9 in. to 1.25 in. of water is maintained in the ash pits and a neutral pressure above the fire. This balance is maintained by the fireroom engineers and only requires adjustment for abnormal conditions, such as increase of load and changes in the thickness of the firebed.

Cooling-Tower Practice.

By J. H. HART.

THE average station manager or superintendent is more or less familiar with the subject of cooling towers. While he may not have an absolutely clear understanding in regard to the theory of the operation of cooling towers, he knows the purpose for which they are created and has no doubt of their efficiency in the majority of cases in view of the large number of installations which are in existence. On the other hand, data in regard to their operation, cost of up-keep, first cost of installation and various difficulties which may be met with in their operation are matters of particular interest, as well as any minor details of construction, operation, etc., which may limit or increase the efficiency of an installation, if one has charge of the operation of such a unit, or more so if one has in contemplation its possible development.

Cooling towers are of two types, open and closed. In the former the cooling of the water is accomplished by air supplied by natural processes, and in the latter by artificial draft. The chief development of the cooling tower is in power-plant practice, especially in cases where available water for boiler supply is not at hand or is undesirable on account of its quality. While the duty in both cases is the cooling of water for re-use in condenser operation, it is esentially dissimilar in the two, since the water which has access to the cooling tower from steam-engine condensers will range in temperature from 150 deg. Fahr. to 170 deg. Fahr. and will be cooled off sometimes to 25 deg. below that of the atmosphere, whereas in refrigeration the maximum seldom exceeds 120 deg. Fahr. and very often does not approach the lower limit attained with steam practice.

Not only is the efficiency of a cooling tower dependent upon the state of the atmosphere with respect to moisture present in it, but often the performance of any duty at all is seriously threatened by these conditions if extreme, and the reliability of the tower is the first criterion by which it should be judged. All cooling towers for their cooling effect upon the water depend upon the amount of air brought in contact with the water and the intimate mixture of the two. The open type depends upon atmospheric agencies for the performance of this duty, while the closed type has its supply of air regulated by means of fans, which may be speeded up under circumstances of poor hygrometric atmospheric conditions, so that the performance of the plant may be kept fairly constant, independent of weather conditions. It is this feature which has led to its installation in the majority of power plants, although the first cost of the closed type is generally from three to four times that of the open, and its efficiency of operation is much limited by the necessary operation of a fan for the maintenance of the air supply at all times. Various outside factors enter as well in influencing this decision. The open tower with a strong wind blowing through it is a source of damage to surrounding property from the spray carried away in the atmosphere and is a serious inconvenience not only to the plant operating it, but may cause much more trouble through law suits arising from its continued maintenance. Cheapness and high efficiency under favorable conditions are the chief characteristics of the open type of tower, whereas the reliability and maintenance factors are the main features in the closed type.

Under the circumstances, there is apparently no question in regard to the relative commercial efficiency of the two types for power-plant practice. Data in regard to their absolute efficiency and the saving possible by their installation from a reduction of fuel, cut in the cost of water, if purchased from outside sources, and more efficient operation of the boiler and other units if the water is impregnated with salts or of an unsatisfactory character, are not at hand to anywhere near the extent they should be for the individual seriously contemplating the installation of one of these units. The majority of the closed type towers are operated in conjunction with steam condensers. The same pump used in operating the condenser is available for duty with the tower. The choice of a type and its efficiency is thus dependent upon the character of the condenser used, the quality of the water at hand, and the cost of same. The majority of cooling tower manufacturers have considerable data at hand in regard to the efficiency of the cooling tower and the saving to be obtained by its use, but they have almost invariably combined the results attained in a series of tests with those obtained with the use of the condenser in power-plant practice and point to the great saving attainable by the use of the condensing feature in conjunction with the cooling tower over that of the power plant without either. There is no question in the mind of the average engineer or station manager in regard to the efficiency of the steam condensing feature. The fact that the cooling tower generally operates in conjunction with the condenser to recool the water used in this and heated by steam condensation, so that it can be user over again, is one that has not been isolated by the great majority of manufacturers operating in this field. A steam condenser can operate very efficiently and increase the efficiency of the power plant as a whole and simply draw its water for cooling purposes from any source obtainable or purchase it from the city. Its efficiency is unquestioned. The cooling tower has encroached on the efficiency of the condenser in an attempt to bolster up its showing in the performance of its own duty and it should undoubtedly stand alone. The question of its installation is essentially a problem in power economics having to do only with small consumption of power if the tower is of the closed type, and of cost of water and cost of water circulatin with the inevitable loss existing in tower operation. Cost of installation and cost of maintenance enter as important factors here as in all such problems. The question of efficiency, first cost, cost of maintenance, and other details will be taken up in order.

The average cooling tower will cool water from steam condensers from 60 deg. Fahr. to 90 deg. Fahr. in one passage of water through the tower, if the tower is of such a type as to present the requisite surface and air supply per gallon of water passed in accordance with the best statistics of the manufacturers. The author has made several tests on towers of both types with respect to the performance of their duty under various hygrometric conditions. The average range in temperature extending over several days is generally from 140 deg. Fahr. to 170 deg. Fahr. and the fall in temperature obtainable has been such that the outflowing water ranged from 90 deg. Fahr. to 60 deg. Fahr. with atmospheric temperatures ranging between 55 deg. Fahr. and 85 deg. Fahr. and hygrometric conditions ranging from 30 per cent to 50 per cent of normal saturation conditions. It is quite possible, as has been said, so to construct the tower from a surface viewpoint and so to direct the air currents that a fall in temperature of the water of from 5 deg. to 25 deg. below the temperature of the atmosphere is attainable. This is largely a question of first cost and operation, however, so that practically any definite temperature of the outflowing water can be attained under average operating conditions of the cooling tower, and can be guaranteed by the contractors or manufacturers of the installation.

An open type of cooling tower capable of cooling from 400 gal. to 600 gal. of water per minute, as dependent upon its special construction, will be, roughly, 20 ft. x 20 ft. x 40 ft. or 45 ft. for cubical contents, and will have at least six so-called drip pans or retarding surfaces in its make-up. The square dimensions are largely eliminated in the construction of these types when the towers exceed a certain size on account of constructive details such as increased length of spans, strength to withstand wind resistance, etc. The majority are rectangular in shape, their wide surface being presented to the normal direction of the wind, since their efficiency is increased on this account because the air immediately loses its cooling property on becoming saturated and it attains this state very quickly on contact with water, especially if the latter is much warmer than itself. The cost of such a tower, with the capacity of 400 gal. per minute, would range from $1,200 to $1,500, and in general it can be said that each additional 100 gal. per minute capacity increases the cost of the open tower type by approximately $200.

This figure, of course, does not hold for especially small types, but begins with about the dimensions and capacity given. The closed type of tower, on the other hand, costs from three to four times this amount for first installation with this capacity, while additional increases range at about double the price given for the open type per 100 gal. per minute additional duty. In regard to cost of operation with fans, circulating pumps, etc., it can be said that a 500-hp plant will require an expenditure in the neighborhood of $2 a day for the satisfactory maintenance and up-keep of the cooling tower alone. This is an outside figure and covers cost of fuel and water wherever used or lost. Thus it includes the power for the operation of the pump and of the air current circulation. This latter is generally accomplished by means of large fans, electrically driven, the fans having an outside reach of from 6 ft. to 8 ft. Serious difficulties often arise during the winter months in the operation of these fans on account of the presence of water in a finely divided state in close contact with the point of operation, and unless properly constructed so as to allow no counter-currents or reverse drafts the fans are apt to clog up with ice produced at these points.

For an outside figure in regard to efficient installation under normal conditions, it can be said that if water costs 6 cents per 1000 gal. or more, it pays to install the cooling tower if the total water lift does not exceed 80 ft. In some cases this figure can be raised to nearly double the amount as far as energy consumption for the circulation of the water is concerned, and any impurity in the water or non-suitability of the latter for feed purposes, or scarcity in its amount, make the possibility of efficiency attainable by an installation of a cooling tower much greater.

After installation or after a decision favorable to installation has been reached, a number of additional factors are worthy of serious consideration. Not only is the location of the cooling tower in the particular plant a matter of serious importance and very effective in its influence on efficiency on account of water and power connections and choice of site as determined by location of other units, but such intangible conditions as hygrometric effects in the atmosphere enter as well. Thus it is a recognized fact that under normal circumstances the hygrometric state of the atmosphere or percentage of moisture is much less at a distance from the ground than at points close to its surface.

A difference or variation in the height of the cooling tower of from 50 ft. to 100 ft. above the surface may affect normal hygrometric conditions to such an extent that average values obtained for this quantity leave a variation at the two points of fully 50 per cent. This phenomenon is well known and considered of great importance in installations in the tropics where moisture conditions are more pronounced. The efficiency of mining installations in the operation of the air compressors is greatly increased by drawing the air for the intake to the air compressor from a stand-pipe from 50 ft. to 100 ft. high if the compressor is located on the surface of the earth, and the efficiency of compression is much increased by the diminution of the moisture percentage present in the air. In the same way when installing cooling towers attention should be given to the sources of air current. A number of such installations have been made to the writer's knowledge in which the fans used in the operation of the cooling tower draw their air supply from the loft of the engine room, which may be especially undesirable if there is a large steam leakage going on. The heating of the air before its passage to the tower is especially desirable if this can be accomplished without affecting the moisture content present in the air.

It is admitted that air drawn from the top of the boiler room or from the vicinity of the smokestack is eminently desirable and within limits the warmer the better, although if allowed to become warm and then exposed to moist or water surfaces it loses its effective properties. The question of temperature of air advent in cooling towers is an extremely important and scientific one before the engineer of to-day. The writer is at present undertaking a series of tests to ascertain exactly the best temperatures for aid at admission, water temperature and hygrometric conditions remaining the same. The warmer the air, the greater its absorptive power for water vapor until it passes the limit where its heat conduction to the water counterbalances any cooling effect due to evaporation.

The theoretical development of this type, however, and the possible methods of increasing its absolute obtainable efficiency, are matters of interest more to the physicist than to the practicing engineer.

Employers' Liability—The Fellow-Servant Rule.

By John Edson Brady.

THE outcome of an action by an employee against his employer for damages for injuries received through the negligence of a fellow servant very often depends upon the jurisdiction in which the action is brought. A case which would warrant a verdict in favor of the employee in one State would, in many other jurisdictions, be decided against him. This condition is due to the diversity of the rules of law which govern the liability of the employer for injuries to those employed. One of the first questions to be determined in fixing the liability of the employer where one servant has been injured through the negligence of another is the question whether the servant injured and the one causing the injury are fellow servants, so as to bring the case within the general rule that the employer is not liable to a servant injured through the negligence of a fellow servant.

In regard to this question of fellow servants there is a considerable diversity of opinion among the courts of different States, although the decided weight of authority is to the effect that all who serve the same master, work under the same control, deriving authority and compensation from the same source, and are engaged in the same general business, although in different grades or departments of it, are fellow servants, each taking the risk of the other's negligence. Like other rules of law, however, this one is not without its exceptions. Its operation has been restricted in many States of the Union, sometimes by the adoption of statutes and sometimes by the decisions of the courts.

One popular exception to the above rule is known as the "superior servant rule," the doctrine under which an employee, having authority to control other employees, is held not to be legally their fellow servant, so as to relieve the employer from liability, where the negligence of the "superior" servant in the exercise of his authority is the cause of injury to one under his control.

There are statutes in some of the States, generally referred to as "Employers' Liability Acts," which have been declared constitutional, and which change the fellow-servant rule in many important particulars. For the present, however, the discussion will be confined to the law as it exists apart from statute. With more or less qualification the superior-servant rule is the settled law in the States of Illinois, Kansas, Kentucky, Louisiana, Nebraska, Ohio, Tennessee, Texas and Utah. And in these States, where this doctrine is recognized, it is said that it has received five distinct interpretations. In other States the rule has been adopted in some cases and discarded in others. For instance, in Missouri the rule was apparently rejected in the earlier cases, but was accepted subsequently, only to be repudiated in the more recent decisions.

It appears that the "superior-servant rule" received its first judicial recognition in this country in the State of Ohio. In that State the courts have gone to the extent of holding that where one employee is injured through the negligence of another who is his superior in rank, the fact that at the time of the accident the superior was performing the duties of a common workman, and not those strictly pertaining to his position as a superior, in nowise relieves the master from liability.—Berea Stone Company vs. Kroft, 31 O. St. 287. In the case of

Little Miami Railroad Company vs. Stevens—20 Ohio 415—it was held that a conductor on a train was a superior servant with regard to the engineer of the train and the company was held liable to the engineer for an injury resulting from the negligence of the conductor. The conductor had disobeyed an order to pass another train at a certain station, and, as a result of his negligent act, a collision occurred and the engineer was hurt.

Quoting from the opinion of the court: "It is said, however, that when a party contracts to perform services, he takes into account the dangers and perils incident to the employment, and receives wages accordingly. Take this for granted; and we think it falls far short of sustaining the main proposition. If the party does contract in reference to the perils incident to the business, he will be presumed to contract in reference to only such as necessarily attend it when conducted with ordinary care and prudence. So far as an implied contract in reference to the business will be presumed, it will be on the hypothesis that the business is to be properly managed. He cannot be presumed to have contracted in reference to injuries inflicted on him by negligence—by wrongful acts. An express stipulation would at least be necessary to make it a part of the contract. The employer has paid him no money for the right to break his legs, or, as in this case, to empty on him the contents of a boiler of scalding water." And in Railroad Company vs. Keary—30 Ohio St. 201—a conductor was held to be a superior servant over a brakeman, and the company was made to pay damages to the brakeman for injuries received in a collision occurring through the negligence of the conductor.

The rule was there stated in this manner: "Where an employer places one person in his employ under the direction of another also in his employ, such employer is liable for injury by the negligence of his superior to the person placed in the subordinate situation." However, in Johnson vs. Cleveland, L. & W. Railroad Company—11 Ohio Cir. Ct. Rep. 555—where a car repairer was injured while working under a car, it was held that the conductor who had ordered the moving of the car, thereby causing the injury, was not a superior servant as to the car repairer. The two were fellow servants, and, under the fellow-servant rule, the company was not legally responsible.

The superior-servant rule obtains in the State of Illinois, where it is phrased in the following terms: "Where the negligence of one servant causes injury to another as a result of the exercise by the negligent servant of authority over the injured servant, which has been conferred upon him by the master, the master is liable." In the case of Hubbard vs. Chicago Sugar Refining Company—44 Ill. App. 418—it appeared that a fire had started in one of the kilns of the sugar company, and that, after it had been extinguished, a scale or crust was left on the floor of the kiln. Two days later this crust ignited and the chemist of the company, who was also its secretary and treasurer and had full control of the works, ordered a fire extinguisher to be played upon the fire. An explosion immediately followed with disastrous results to the plaintiff.

A judgment in favor of the defendant company was reversed on appeal for the reason that the trial judge, in his instructions to the jury, had told them that if the chemist and the plaintiff were working together in the attempt to put out the fire they were fellow servants and the plaintiff could not recover notwithstanding that the chemist was the general superintendent of the plant. "The true rule," said the court, "is this: The mere fact that one of a number of servants who are in the habit of working together in the same line of employment for a common master has power to control and direct the action of the others with respect to such employment, will not of itself render the master liable for the negligence of the governing servant, resulting in an injury to one of the others without regard to other circumstances. On the other hand, the mere fact that the servant exercising such authority labors with the others as a common hand will not exonerate the master from liability for the former's negligence in the exercise of his authority over the others. Every case in this respect must depend on its own circumstances."

In Fraser vs. Hand—33 Ill. App. 153—the plaintiff was a helper working with a molder in the defendant's foundry and it was his duty to obey the molder. While they were moving a "flask" by means of a crane, the handles on one side of which had been broken off, the accident occurred. The molder, in his capacity as superior, told the helper to hook to the flange of the flask the chain by which the flask was to be raised. After the flask had been raised in this manner the chain slipped and the flask dropped on the helper's toes. The accident occurred while the plaintiff was obeying the orders of a superior and, under the rule laid down, the company was held liable.

The application of the superior-servant rule is also illustrated by the Illinois Steel Company vs. Schymanowski—162 Ill. 447. The plaintiff in that case was employed by the defendant company in its shops. On the night of the accident he was put to work loosening ore from a large pile for removal to the furnaces. It being very dark, the plaintiff sought out his foreman and asked that a better light be provided. Instead of complying with this request, the foreman told the plaintiff, in no mild language, as the record shows, to "go to work." The plaintiff returned to the pile and shortly afterward a large piece of ore fell from the top of the pile and crushed the plaintiff's leg. The company had to pay damages. The command of the foreman that the plaintiff "go to work" was within the scope of his authority, and it was therefore the command of the company itself.

When the master orders the employee to perform his work the latter has a right to assume that the former, with his superior knowledge of the facts, would not expose him to unnecessary perils; the servant has a right to rest upon the assurance that there is no danger, which is implied by such an order. Though it may seem that the law gives the advantage to the servant, it must be remembered that the master and the servant are not altogether upon an equal footing; the advantage here lies with the master and the law seeks to strike a balance. Another Illinois case, where the plaintiff was injured while carrying out the orders of his foreman, is that of Anderson Pressed Brick Company vs. Sobkowiak—148 Ill. 573. Sobkowiak was employed by the company as a shoveler. One John Keily was the foreman in charge and had complete authority over the work. He hired and discharged the men, kept their time and directed and controlled their actions. There was an overhanging bank, under which it was necessary for the men to work in getting out the clay which was being removed. Keily's attention was called to the bank and one of the men suggested that it be taken down before any further work was done.

Keily replied that the surface soil would contaminate the clay and that, in case of accident, he could find others to take the places of those injured. A cart was accordingly backed under the bank. Keily's son was the driver and Keily told him that if he got word to drive out not to waste any time doing so. There was some discussion among the men as to which of them should shovel from a position back of the cart and Keily settled the matter by ordering Sobkowiak to work at that point. The bank tumbled down and, though the driver and the men working at the sides of the cart got out safely, Sobkowiak was caught in the falling earth and seriously injured, so seriously, in fact, that the jury awarded him $8,500; the Appellate subsequently reduced the amount to $6,000. It was reasoned that Sobkowiak had a right to assume that his foreman, having wider experience and superior opportunities for knowing the condition of the bank, would not order him into a place dangerous to life and limb. It was for the jury to say whether the act of Sobkowiak in going under the bank and back of the cart, in obedience to the command of his superior, was a piece of recklessness which would defeat his right to damages, and the jury said that, under the circumstances, it was an act such as might have been done by a reasonably prudent person acting with due regard to his own personal safety.

THE ELECTRIC FAN AND THE CENTRAL STATION

The Fan Business of the Public Service Corporation of New Jersey.

By William H. Stuart.

THE fan business throughout the system of the Public Service Corporation of New Jersey is one that has been developed year by year until to-day it plays an important part in the summer business of the company. The Public Service Corporation supplies energy to a great many places throughout the State of New Jersey, from the small township of a few hundred inhabitants to the larger cities like Newark, Jersey City, Trenton and Paterson. These several places are somewhat different in character from one another, and the difference has regulated the introduction of the fan business. That is, in the different places some particular class of consumers, such as the business houses, or stores, or factories, or residences, were more readily susceptible and responsive to the soliciting for fan service than in other localities, because that class predominated. For instance, in Jersey City the fans were more readily and quickly introduced among the commercial customers, and to-day there are more fans per consumer in business places than in the residences.

For a long time in some of the cities there was operated a flat-rate ceiling-fan service for commercial customers. This service was run without meter, and the consumer paid so much per fan and guaranteed to stop using it at a specified time. The amount per fan was based on a stopping time of 7 p.m., 9 p. m. or 12 p. m. each night. There was an all-night rate also. The energy was available for the 24 hours each day, but it was left to the honor of the consumer to turn off the fans as per his contract. If a persistent breaking of the agreement was noticed, the service would be discontinued altogether or else the consumer would be charged on an all-night basis. The season lasted four months, from May 15 to Sept. 15. As the portable fans became more and more popular the flat-rate service was done away with gradually. No new consumers were accepted on the old schedule, and while it was optional with the old consumers to continue at the flat rate or to be charged on a meter basis, the consumers were advised to adopt the metered service. Considerable business is now done with ceiling fans among the commercial consumers. When the portable fan began to show its qualities the company made exceptional efforts to install as many as possible. Very fine results were obtained and the use of the fans became quite extensive.

In 1909, as in the past, the company will carry out the same methods of introducing fans throughout its territory. At about the first of April of each year considerable space in the daily newspapers is used for displaying attractive advertising cuts with short, sharp and catchy wording. In conjunction with this advertising, special illustrated folders are drawn up and placed in all of the offices for distribution to the public and for mailing. Upon the backs of the monthly bills there appear brief notices concerning the fans and their advantages. Manufacturers' advertising matter is used in the offices and show rooms, but not to a great extent. By the time that this amount of advertising has got into circulation and a little warm weather has been experienced to further impress fans upon the mind of the public, quite an amount of business will have been transacted. A reasonable amount of time is allowed for the advertising to produce effects, and then the solicitors are instructed to pay particular attention to securing and following up all leads to secure the business.

The company purchases a large number of fans each year from one of the well-known makers and has them shipped to the various offices where they are assembled, cleaned and placed in stock. They are arranged in an attractive manner about the show room and an exhibit is made of them in the show windows. In the display generally most of the fans are in operation and, to further attract an observer's attention, small ribbons and flags attached to the wire guard are allowed to flutter in the breeze. Another scheme was to blow colored balls about the window by the fans. Show-window cards, neatly printed, stating the name, size and price of the fans were also placed in the windows. The fans were sold at about cost in most of the offices, and with each fan there was included 10 ft. of flexible cord and an attachment plug. A feature which proved most successful and beneficial was the prompt delivery and the quickness with which a fan once purchased was set in operation.

There is another force at work assisting the company, namely, the wiring contractors. A great many fans have been sold and placed in operation through this agency. The company has invited a spirit of co-operation between the contractors and itself, the prices being fair to all parties, and "leads" for business are freely exchanged. Of course, in a great many places it was found to be better for the company to sell the fans. The company handled only the portable fans and allowed the contractors to sell and install all other styles.

While it has not been possible to secure any definite figures as to the number of fans in use upon the company's lines, yet it is estimated that there is one fan for every two consumers, and in the near future every consumer will have at least one fan. While the company will not deviate very much from its former methods of handling the fan business, yet with the resumption of its extensive advertising and publicity system it is expected that some attractive advertising matter will be issued. Altogether the company is preparing for and expects to do considerably more fan business this year than it has in any other year.

Electric Fans on the New York Edison Company's Service.

By Norman G. Meade.

ELECTRIC fans have become so extensively adopted in New York City that it is beyond the scope of this article to do more than outline some of the many useful applications in every-day use. The desk, bracket, ceiling and small revolving fans suspended from chandeliers have long been a familiar sight in offices and stores, circulating air for the comfort of occupants and patrons.

The one-time limited field has expanded through the ideas of ingenious people until there are many novel and useful purposes to which the electric fan is applied. It is now considered practically a necessity in private houses and apartments as well as public places, and the low operating cost brings it within reach of everyone.

So fast has the use of fan motors grown that they have become an important factor on the system of the Edison company, and indications point to a far greater business in that branch during the season of 1909 than has ever been done before. A conservative estimate places the number of electric fans operating on Edison service at about 250,000. Their particular uses are diversified in the extreme and are by no means confined to the popular conception of their function—i. e., circulating cooling breezes. Despite this fact there seems to be little effort on the part of manufacturers of fan motors to push their product for other purposes than relief from the heat. The New York Edison Company long ago realized that the fan motor had many uses in cold as well as warm weather, and has advocated persistently its adaptability to numerous novel purposes.

One quite extensive application in New York, where fans are used to advantage in winter, is to blow warm air from a steam or hot-water radiator into a room, thereby greatly increasing the heating capacity and giving a more even distribution of heat. This arrangement is found especially valuable

where the heating system is not adequate to meet the requirements. Another use which is more or less familiar to the majority of pedestrians in the business district is the blowing of warm air against show windows for the prevention of moisture condensation. Storekeepers, especially florists, find this application of the small fan very serviceable in the winter months for frustrating the accumulation of frost upon the glass which conceals the window display from passers-by.

The use of a fan for circulating pure air through a refrigerator in the winter is not only novel, but effects considerable economy, as the use of ice may be confined to the hot months of the year. There are several different arrangements that can be made, depending upon the style of the refrigerator.

One of the later developments in the use of the electric fan, where houses are heated with hot-air furnaces, is creating forced draft. This has met with such success that no electrical appliance is likely to meet with more favor. It shortens the time for heating the house in the morning, and makes it possible to maintain a comfortable temperature in rooms that on account of poor, natural circulation have been difficult to warm. The opening or casing into the cold-air inlet, through which the fan blows, is made approximately the diameter of the fan in order to create a good pressure. Various methods of installing and controlling the fans suggest themselves to meet the requirements in each case. Chains, similar to those used for raising and lowering the drafts, have been utilized for regulating the fan's speed. Arrangements are generally made to move the fan backward away from the cold-air inlet when it is not in use, and a slide is provided for covering the opening. The foregoing applications are for cold-weather use, and should dispel any ideas people may have that the electric fan is essentially a warm-weather device.

In theaters, public buildings, hotels, etc., the use of electric fans of all types is almost universal, and they are rapidly being adapted to the needs of private residences, where they are found practically invaluable in the living rooms and bedrooms, especially in cases of sickness. The rooms in a number of leading hotels are provided with ceiling fans, which add greatly to the comfort of guests in hot weather.

For ventilating kitchens, lavatories and all rooms where heat and odors are prevalent, fan motors are useful in any season of the year, and many are in constant use in New York City. Ventilation may be accomplished by circulating air directly through the room, but preferably it is done by placing the fan on a bracket adjacent to the upper pane of glass in a window, through which a circular hole, approximately the diameter of the fan, has been cut. By placing the blades close to the opening so that the fan can blow outward, a very effective exhaust is obtained.

The question of proper ventilation is one that is especially prominent in these days of careful attention to hygiene. It is being realized more and more that fresh air is one of the most important factors of healthy living. In areas too large for the small fan to ventilate effectually, a great number of larger electric fans, built especially for ventilating purposes, are in use and have been found of great benefit. In this connection it is interesting to note the frequency with which air can be changed in public buildings to insure health and comfort as prescribed by authorities on the subject. In large public rooms the air should be changed every 10 to 20 minutes; in factories and workshops, every 5 to 20 minutes, depending upon the work being done; and in shops, offices, halls and churches, every 20 minutes.

To ventilate public buildings to this extent without giving rise to complaints from numerous persons who are sensitive to drafts, has not in the past been an easy task. The electric fan offers a simple solution of all difficulties in the way of ventilation, as it can be fixed in any out-of-the-way place and controlled from any convenient point. A ventilating fan of the proper type is generally arranged in a circular aperture in the wall, and can be regulated to draw in fresh air or to expel the vitiated air.

Under the ideal conditions the room to be ventilated has only one inlet for air, which is located at the opposite side of the room from the exhaust fan. The size of the fan depends largely upon local conditions, but common practice is to use about an 18-in. fan to provide fresh air for about every 25 or 30 persons, allowing 2000 cu. ft. of air per hour for each occupant of the room.

For advertising purposes in show windows the electric fan is used by many merchants for keeping light objects, such as toy balloons or bits of paper, in constant agitation, and maintaining streamers and small flags in a horizontal position. Very novel and attractive effects can be secured that demand attention and prove to be good advertising.

Among the photographers of the city electric fans are extensively used for drying negatives and prints. Those familiar with the business will realize what an advantage quick drying by this means is, as it enables much more work to be turned out in a given time.

A novel form of electrically operated fan which has been largely used in England and on the Continent is being introduced into New York. In this type of fan, known as the "Punkah," the regulation revolving blades are replaced by swinging blades operated with a small motor. The air in the room is thus kept in a state of gentle agitation, which is preferred by some people to a strong breeze from an ordinary electric fan.

Fan Motor Experience in Boston.

The Edison Electric Illuminating Company of Boston has been paying special attention to the electric fan situation for about eight years. For many years the company has sold fans to its customers in order to encourage this character of load in every way possible. The company early recognized that the electric fan has many other uses than the cooling of relatively small interiors, and has done what it could to develop the use of small fans at all seasons of the year. Small as is the energy demand of the single fan, it provides a load of the most desirable character, for the reason that it is of the long-hour kind, generally extending far beyond and in advance of the station peak, and in many cases requiring energy continuously through the night. The multiplied effect of many hundreds of fans on the system is believed to be thoroughly beneficial, particularly as all small fans are operated under the company's regular commercial incandescent lighting rates. At these rates the cost of operating an ordinary 12-in. fan in Boston is about .06 cent per hour.

About eight years ago the company decided to introduce a rental plan in connection with the use of electric fans, in order to popularize these devices and offset to some degree the fluctuations in the regular market prices of this equipment. It was considered desirable to introduce small fans under conditions which might be taken advantage of by customers with small initial expense, and to effect this a kind of cycle was adopted by the company in its fan exploitation. In general the following plan has been pursued:

The company bought a lot of fans of the 12-in., 110-volt type, both alternating- and direct-current design, the number varying according to the anticipated demand for fans for the season. These fans are kept in the regular stock department of the company and drawn out for distribution on requisitions from either the sales department or the installation department. In connection with its monthly bills, the company then mails a blank in the form of an application for renting one or more fan motors at the rate of $1 per month, the minimum charge for the season being $3. These blanks constitute an announcement of the availability of fans for service through the agency of the company.

When a fan is rented the record of its number, type, location, date of sending out and date of return or purchase is recorded in a card index in the installation department, one card being used for each fan. At any time the company can, therefore, tell the exact history of all fans which it has handled, but no

record is available of fans purchased and installed by customers from other agencies than the company itself. For this reason it is most difficult to estimate with any accuracy the total number of electric fans in service on the circuits of the Boston Edison Company. The small fan has become a standard article in this territory, however, and is used most widely and in a great variety of mercantile, industrial and residential installations.

The company's practice has been to maintain rented fans under good usage by consumers. When fans need repairing they are not usually attended to by the Edison company, but are sent to an electrical repair house in Boston which makes a specialty of such work, under contract with the Edison organization. After the fans have been in use for about three months the company's canvassers look up the fans still on rental, some having been purchased in the meanwhile by the company's customers. The fans that are still on rental are offered to the customer at the regular retail price less what has been paid in rentals. In this way the customer finds it possible to buy a fan at a very reasonable rate, and the company has sold numerous fans in this way. Possibly two-thirds of the fans are returned at the end of the season.

At the beginning of the second year of the fan cycle the unsold fans are put in thorough order by the electrical repair house, if they have not been gone over at the end of the first year. These are now second-hand fans in first-class shape. In the spring the customers are notified by announcements in their bill envelopes that the company has a limited number of second-hand fans for sale, the fans being in good condition and ready for commercial service. A blank order is enclosed, and on cash payment the company delivers the fan. In all cases within its territory no charge is made by the company for delivery, the fans being carried to their destinations by the company's regular transportation department. The second-hand fans are not guaranteed, and the company does not maintain them, as in the case of rented fans. After all the second-hand fans are sold—and usually this is done very quickly—the company may find it necessary to buy more fans. In such an event a small lot is bought and sold at the regular retail rates.

In the third year the company carries a comparatively limited stock of new fans into the season and sells them at the market rates, the number on hand naturally being dependent upon the demand of the previous season. In this third year the policy of the company is to let the whole fan situation largely take care of itself, so far as the purchase of fans is concerned. Any fans handled are simply sold at the usual retail price. The demand of the previous two years tends to be prolonged somewhat, with the resulting purchase of fans from the regular dealers by consumers. At the beginning of the fourth year the company is ready to buy a lot of fans and start the rental process moving again, and thus the cycle continues. Any persons not customers of the company are required to pay cash on delivery of fans bought of the company. Regular consumers may buy on the usual terms of cash in 30 days.

The company does not loan fans free of charge and fans are rented only to customers. Deliveries can usually be made within 24 hours. The company endeavors to make enough profit in handling the fans to pay it to undertake the work, but it appreciates the value of the fan as an energy consumer, and views the whole problem from that standpoint. All fans are tested for proper running before being sent out. The company's inspectors adjust rented fans only.

In cases where special fans are required the company buys them for its customers if so requested. In the past season, for example, a large number of 16-in. alternating-current fans of the oscillating type were purchased for consumers. The company does not install large fans, but recommends this work being done by electrical contractors. When desired the company will advise its customers as to the best arrangement of fans for different services.

One of the largest recent installations of the 12-in. fan by the company was in a new publishing house, where about 40 were placed on a single order. The general situation in the fan field has been discussed frequently by the officers of the sales department at conferences with solicitors, especially in the line of pointing out the uses of fans in unusual applications or in less familiar fields. Among these are the keeping of window panes clear from frost in winter, improving the ventilation in residences in connection with furnace air-inlets and registers, hair drying, photographic-plate drying, keeping fruit free from insects and the drying of clothes in seasons of inclement weather.

The company does not attempt to list fans on its circuits that have been purchased outside its own organization. All of the prominent and reliable makers of electric fans receive equal consideration by the company in purchasing. At times the company has employed newspaper advertising to a limited degree for fan exploitation. Fans are used extensively by the company in its own service, both as an object lesson and as a convenience. The fan motor is so well established in the public's favor that educational campaigns in this field are not considered necessary. Probably the chief difficulty in the commercial handling of fans is their first cost. The user does not consider the cost of operation as serious, in view of the comparison with the ordinary carbon-filament incandescent lamp. The cost of the fan in the first place is largely overcome in Boston by the policy outlined above.

Fan Motor Situation in Various Cities.

The electric fan increases in popularity year by year. Consuming ordinarily only about as much energy as the carbon-filament incandescent lamp, it would appear offhand that the revenue obtainable because of its use would be inconsiderable, excepting possibly in very large cities or in places where climatic conditions are such as to make its utilization an absolute necessity. Investigation, however, shows that the yearly income from fan motors is by no means insignificant. Time and experience have combined to widen the field of this sturdy little electrical appliance. Its usefulness is no longer limited to the warm months of the year, although it is especially serviceable during the summer season, and fan-motor peak loads naturally come at a time when the lighting load is smallest, and when some other additional load is welcome. As a piece of electrical apparatus, the fan motor is at once one of the most reliable and one of the best appreciated. It possesses the merit of advertising itself, and after having once experienced its comforting breezes the user it loath to part with it. Some idea of its value as a central-station load may be obtained from the experiences of various companies throughout the country who are cognizant of its worth. The difficulty of securing a record of the number of fans in use will be appreciated when one recalls that they are fed from the lighting circuits and are purchased usually from a supply store or from an electrical contractor. In some cities the electric light company has made a special campaign on electric fans and thus hastened their introduction, while in others fan motors are loaned to customers at very low rates. A short account of the practice in a few cities selected at random may be of interest.

The Charleston (S. C.) Consolidated Railway, Gas & Electric Company looks upon a fan-motor load as being very desirable. Its fan-motor business covers a period of six months, beginning with the month of May and ending with the month of October, during which period the lighting load is at a minimum and the fan-motor load at a maximum. During the month of August, 1908, the books of the company showed that there were 700 fans connected on a flat rate and approximately 300 fed from meters. The average receipts were approximately $2,000 per month, or $12,000 per annum. The company does not sell or handle fan motors nor does it make a fan-motor campaign. It depends upon the supply houses and the electrical contractors to increase the business, co-operating with them and lending them assistance whenever possible. At one time the company sold fans and employed solicitors for the purpose of get-

ting new business with the result that the supply houses were virtually put out of business. This campaign, which was conducted at considerable expense, did not result in any appreciable increase in load and another campaign was not attempted. The company now adds about 250 fans to its circuits yearly without expense to itself.

The Union Electric Light & Power Company, of St. Louis, Mo., makes a canvass each year for fan-motor business. In this it depends entirely upon its soliciting force, doing very little advertising other than making one or two announcements each season. In the past the company has made a flat rate for ventilating service during the summer months ranging from $12 to $15 per fan per season. Where they so desire, customers may connect their fans to the lighting circuits and thus pay for the energy used at the same rate as for energy used in lamps. Owing to the large number of fans connected to the lighting circuits, the number of fans and the actual revenue obtainable from this source cannot be ascertained definitely. From such records as are available the company estimates that there are approximately 5000 ceiling fans and as many desk fans connected to its lines. The hot season at St. Louis being rather long, the revenue from 10,000 fans is by no means small.

Coming now to cities farther north, where the warm weather does not extend over so great a period as in Southern cities, it is not unusual to find the central-station company making every effort to capture a greater fan-motor load. The Philadelphia Electric Company estimates that the number of fans connected to its circuits is in the neighborhood of 10,000. From the 5580 fans of which it has a record, the approximate income for the summer season is from $20,000 to $25,000. An endeavor is made to obtain an accurate count of the fans connected by having a recount made whenever a meter test is made. Every year a short advertising campaign is carried on for the purpose of encouraging the introduction of fans. This campaign is a simple one, but the company endeavors to make it as effective as possible, bearing in mind the fact that the income from the fan business will only permit of a limited expense in the way of advertising. The method is to circularize the various mailing lists of non-consumers with folders about three times; the first about the middle of May, the second about the first of June and the third on the first very hot day in June. These folders are supplemented with a little newspaper advertising. The company has found that it does not pay to send out advertising specifically for the encouragement of the use of fans after July 1. It has been its experience that if the fan service is not introduced before that time by non-consumers it is not liable to be introduced at all. Bulletins and inserts advertising fans are sent to customers with bills. The uses to which fans are put are about the same as in other cities similarly located. In addition to the regular uses, the fans are employed in barber shops and hair-dressing establishments for hair drying; for ventilating windows; for window display work; for drying prints in drafting rooms; for drying plates and prints in photographers' galleries; for drying leather belting and for various ventilating purposes in kitchens.

On account of the climatic conditions, the use of fan motors in Rochester, N. Y., is not as general as in cities where the heat is more intense. The Rochester Railway & Light Company has, however, a large number of fans installed for use in the regular way during the summer season, and in addition the company recommends and advertises electric fans for the following purposes: In winter, to keep frost from show windows; to increase the heating capacity of radiators in rooms which on acocunt of lack of radiating surface cannot be kept warm; to force draft of air in the intake of hot-air furnaces and thus increase the circulation of heated air in the house. The company also advises the use of fan motors in stables in the summer to keep flies away and to permit horses to rest in comfort. It is impossible for the company to state the exact revenue it receives from fan motors, since these are supplied with energy from the regular house meter. There are about 200 fans in constant use during the winter alone.

The Hartford (Conn.) Electric Light Company has about 700 fans connected to its circuits. Several years ago when the fan motor was first introduced, the company had the agency for ceiling and desk fans and aggressively pushed the sale of these motors. In later years, since the fan motor has become more thoroughly established, the company has turned this end of the business over to the electrical contractors. As in other cities where the fans are fed with energy from service meters, it is impossible to obtain an accurate record of the amount of energy consumed by fan motors.

There are about 5000 fans connected to the circuits of the Narragansett Electric Lighting Company, of Providence, R. I., although the company has never kept any separate record of the number of fans connected to its system or the energy consumption, income, etc. The company has always made an effort to encourage the use of fans, but has never sold any, preferring to co-operate with the electrical contractors and supply houses. Circulars designed and written by an advertising company and printed at the expense of the electrical supply houses are mailed to the company's patrons and are also enclosed with bills. The electrical supply houses and contractors of Providence also advertise in the newspapers the advantages of the electric fan.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has tried two or three fan campaigns. The most successful campaign was pursued about three years ago when the company purchased 1500 fans and sold them direct to consumers during the winter and spring. This campaign was dubbed "Midwinter Sale of Electric Fans," and it was accomplished wholly through advertising. A feature of the advertising was the announcement that the sale lasted only until May 15 and that no fans would be sold at a reduced price after that date. The company disposed of its entire stock and felt that it could have sold a great many more at the time. The sale caused some friction with contractors and local dealers, and the company's subsequent relations with the contractors has been such that it has never repeated the effort, although it was, and is, satisfied that it can dispose of more fans direct than in any other way. Last season the company attempted a fan campaign somewhat on the following lines: It purchased a stock of fans and placed them on consignment with the local contractors, sending out advertising matter on fans to its customers and referring would-be purchasers to a list of consignee contractors. This plan did not work as well as the company had hoped, and at the end of the season the company had a large stock of fan motors on hand. Hiring several wagons, the company "peddled" this stock from door to door among electricity users, but did not succeed in getting rid of all of the fans. The number of fans in use cannot be estimated with any degree of accuracy, but is quite large.

In Cincinnati, Ohio, the Union Gas & Electric Company has connected to its system 2267 direct-current fans and 376 alternating-current fans. The company has not made any special fan-motor campaign, although fans are on sale at the main office of the company and also handled by the electric contractors and jobbers. Inasmuch as the fans are connected to the meters from which the lighting load is also fed, no record of the energy consumed or of the revenue obtained from fans is obtainable.

The Edison Illuminating Company of Detroit, Mich., does not of itself push fans, as its system of charging does not include fans in the base rate. However, energy used for such purposes is charged for at a rate of 4 cents per kw-hour, and this rate has encouraged the use of fans to a considerable extent. The local supply dealers succeeded in disposing of 500 portable fans last season, and the company estimates that about 2000 fans are owned by patrons, 80 per cent of these being used by commercial customers and 20 per cent in residences. The company contemplates pushing the fan motor among its resident customers for the coming summer, but no definite plan has been outlined as yet. The probabilities are that the fans will be sent out on a rental basis.

The Commonwealth Edison Company of Chicago has always believed in pushing electric fans. It has found that the introduction of these widely recognized conveniences has proved

an entering wedge for other business. In many cases the installation of fans has been followed by orders for electric lamps or small motors. Following are some of the ideas used by this company in its fan campaign as developed in various kinds of advertising matter. Good results from newspaper advertising are reported by Mr. G. B. Johnson, of the contract department of the Commonwealth company, who is familiar with the subject. The advertising copy is prepared ahead of time and is held in reserve for the first indication of a hot wave. The striking is done while the iron is hot, and as a result, anyone entering the salesroom of the company on a warm day in summer might imagine himself in a bargain-counter rush in a department store, the demand for fans is so great. Last summer the regular solicitors of the company were given a special commission for each fan sold. Further, a prize of $10 was awarded to the solicitor in each district securing the greatest number of fan orders within a given period.

When Sultry Clouds Hang Over the City
and the air is oppressively hot, the gentle breeze of an electric fan can do much to revive and refresh you.
For Less Than 1c Per Hour
you can operate a fan at home or in your office. The investment will pay you many times over, in comfort, better work by yourself and employes, less fretful children at home and sounder sleep. Fans are not expensive. Call Main 1280.
Commonwealth Edison Company
139 Adams Street

FAN ADVERTISEMENT OF COMMONWEALTH EDISON COMPANY.

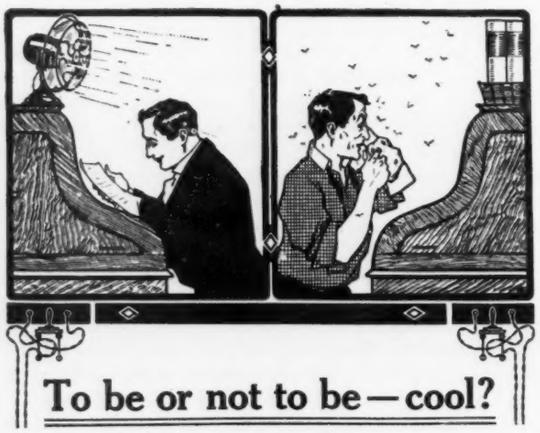
Fans were also sent out on approval, with the understanding that the customer had the privilege of returning them within two days if he did not wish to keep them. But if the user did not avail himself of that right, a bill was sent for the goods. An advertisement was inserted in the daily papers containing a coupon, upon receipt of which a fan would be sent, with a demonstrator, who would connect and demonstrate it free of charge, at the same time securing the order if possible. A combination advertisement contained a picture of a lady using an electric flatiron and also an electric fan. It emphasized this declaration: "Ironing Day a Pleasure in Summer with an Electric Flatiron and Electric Fan." This announcement brought good results. It was used in theater programs as well as in the daily papers. Several samples of advertisements are reproduced herewith, one in full and two others, owing to limitations of space, with the reading matter omitted. Other mediums for fan advertising were cards in the elevated and surface cars and direct-by-mail methods. The fan situation in Chicago passed the preliminary stage several years ago. The public is now being educated by means of advertising and soliciting to consider electric fans no longer a luxury but a necessity in every modern store, office and home.

The Buffalo General Electric Company estimates that it has about 2000 fans connected to its circuits; but there are so many fan motors which, because they can be so easily attached by a

ELECTRIC FAN ADVERTISEMENT.

flexible cord and plug to any lamp receptacle, are not reported for inspection and of which the company has no knowledge, that the exact number in use is difficult to ascertain. The fans are used on both the alternating-current and the direct-current lighting circuits and are used chiefly in stores, offices and in other business places, notably in saloons. The rate for energy varies between 3 cents and 7 cents per kw-hour. Only a few fans are used in residences where the rate for energy is 9 cents per kw-hour. The company occasionally installs fans for a few days in a sick room in residences during the summer months. A charge of $2 a month is often the rate for the small electric fan blowers used by blacksmiths, etc., but these are usually larger than the ordinary desk and ceiling fans.

In the Rocky Mountain region, the Denver Gas & Electric Company has about 1500 fans operating on its lines. This number is greatly increased during the summer months. The company receives a revenue from its fans of $3 per month, gross flat rate subject to 10 per cent discount, so that the net revenue



ELECTRIC FAN ADVERTISEMENT.

per fan per month is $2.70. The standard 12-in. and 16-in. fans are used for the following purposes: Cooling a room; preventing flies from entering a room by creating a draft at the doorway; operating small washing machines in residences; operating small window displays and for operating small portable lathes for jewelers. Every fan is installed free of charge

and the energy is supplied to it free for a month. If desired, the fan can be purchased outright or rented at the rate of $1 per month.

Farther west, the Pacific Gas & Electric Company, of San Francisco, rents fans during the summer months in the interior cities where flat-rate electric systems prevail. The season lasts approximately six months, commencing with May, and the rate charged for the season is $12. This includes rental and energy used. For patrons who own fans the company makes a practice of charging for energy at the rate of $8 for the season. In the territory served by the company there are approximately 500 fans in use during the summer months and the revenue derived from these is estimated at $4,000 for the year. The company does not make a campaign with the idea of increasing the use of fans, as generally in the interior valley towns, the hot weather itself is sufficient justification for the installation of electric fans by everyone having electricity. In the cooler towns on the coast, electric fans are not used to any extent. The climate in San Francisco, Oakland, Berkeley and on the peninsulas of Marin and San Francisco is so salubrious that fans are rarely needed.

Measuring the Input and Output of a Storage Battery Automatically.

It is customary in a number of stations operating with storage batteries to measure the input and output of the battery by means of two watt-hour meters, which are thrown in and out of circuit manually or by means of an automatic throw-over arrangement of some sort depending for its operation on the reversal of polarity. The chief electrician and his assistants of the Central Pennsylvania Traction Company of Harrisburg, Pa., have devised a home-made and inexpensive appliance to accomplish the same result. In this station, a description of which appeared in these columns April 27, 1907, there is a battery of 288 chloride cells having a normal rating of 800 amp-hours and a maximum temporary output of 1400 amp-hours.

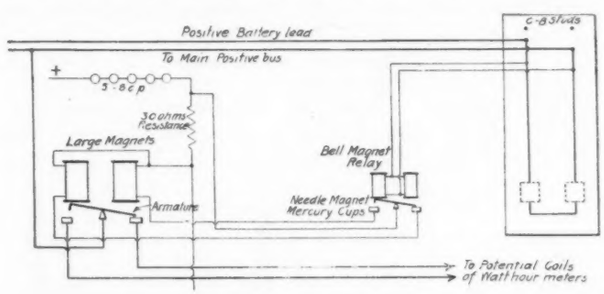


DIAGRAM OF CONNECTIONS.

Deeming it advisable to measure the input and output of the battery and being unable to procure an inexpensive device in the market, the engineer and his assistants set about to devise one. It so happened that two watt-hour meters and two ammeters mounted on two unused feeder panels were available for this purpose, so no expense was incurred for measuring instruments. Since the watt-hour meters gave exactly the information required the ammeters were unnecessary.

The watt-hour meters were connected as shown in the accompanying diagram, in circuit with the positive battery leads which feed into or out of the main positive bus, through circuit-breaker studs. A relay circuit composed of a pair of ordinary bell magnets is placed across the meters in shunt with the main circuit. Owing to the low voltage, the magnets are connected in parallel, and as the current flows either to or from the battery, these magnets alternately attract and repel a permanent magnet needle carried below them. This needle is suspended on a post in circuit with the operating current which comes through five 8-cp lamps. As the needle dips into one or the other of the mercury cups shown, current is sent through a pair of large magnets which lift alternately the ends of the armature beneath them, thus causing the other end of the armature to close the circuit leading to the potential coils of either the watt-hour meter measuring the input or the one measuring the output, as the case may be. Cut-outs are supplied for all circuits, but have been omitted from the diagram for the sake of simplicity. A resistor with a resistance of 30 ohms is placed in the lamp circuit so as to reduce the sparking when the circuit is opened.

Tests on Boiler Setting by Marion Light & Heating Company.

Some interesting tests were recently made at the plant of the Marion Light & Heat Company, at Marion, Ind., on boiler setting. An Edgemoor boiler of 300-hp rated capacity was first tested with the ordinary three-pass setting, with the grates under the boilers, as in the usual construction. The setting was then changed so as to make five passes of the furnace gases in the boiler, and a Dutch oven, extending 3 ft. in front of the boiler, was installed. The results of the tests before and after making this change are given in the accompanying table,

	Before.	After.
Duration	8½ hrs.	8½ hrs.
Draft	Stack	Stack
Stack	5′ x 100′	5′ x 100′
Grate	7′ 6″ x 8′ 3″ = 62.2 sq. ft.	7′ 6″ x 8′ 3″ = 62.2 sq. ft.
Air opening	40%	40%
Steam pressure, average	155	152.8
Furnace draft	.38″	.36″
Stack draft above breech	.735″	.772″
Feed water temperature, F., deg	188.5	187.
Stack temperature, deg	647	572.6
Kind coal used	⅝″ ill. screenings.	⅝″ ill. screenings.
Amount coal burned	15,476	13,140
Moisture in coal	9%	11%
Dry coal burned	14,083	11,694
Ash	2,317	1,115
Per cent ash	14.9%	8.4%
Dry coal per hour	1656.8	1375.8
Dry coal per sq. ft. grate surface per hour	26.4	21.9
Total water evaporation	74,845	77,064
Factor of evaporation	1.0749	1.0756
Water, fire and ash, 212 deg	80,450	82,890
Water evaporated per hour	8805.3	9066
Water evaporated per hour, fire and ash, 212 deg	9464.7	9751.7
Evaporation per pound dry coal	5.31	6.4
Evaporation per pound dry coal, fire and ash, 212 deg.	5.71	7.09
Commercial horse-power developed	274.2	282.3
Builder's rating	300.	300.
Per cent of rating	91.4	94.1
Moisture in coal	9	11
Efficiency of boiler and grate	45.22	55.4
Efficiency of boiler only	55.49	61.3
Grate used	Kelly shaking grates.	Same.
Per cent of CO_2	7.8	8.

for which we are indebted to Mr. S. H. Smith, superintendent of the company.

It is estimated by Mr. Smith that this change in setting under the conditions in which this boiler is operated will probably cause a saving of about 1400 tons of coal per year. As shown by the table, the evaporation in pounds of water per pound of dry coal was raised from 5.71 to 7.09. The reason for the increased efficiency is to be found, first, in the high furnace temperature permitted by the Dutch oven. The brick top of the Dutch oven, being at a high temperature, does not cool down the gases as they rise from the coal, and so combustion is thoroughly started in the oven before the gases reach the boiler. When the boiler is reached, the added number of passes which the gases must make gives the boiler tubes more opportunity to extract heat from the gases, while dead pockets in the boiler setting are eliminated.

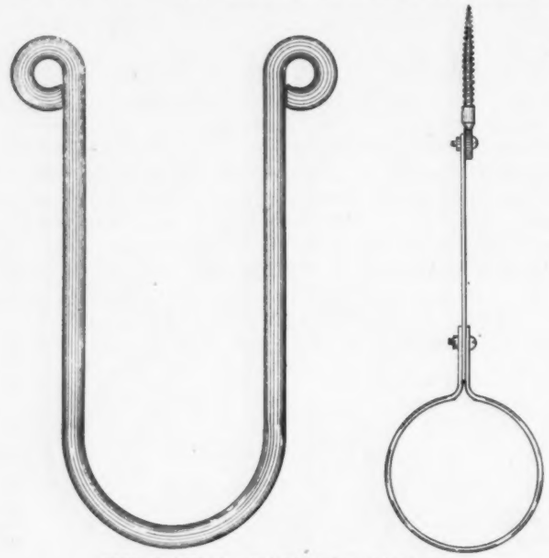
Pipe-Hangers.

BY W. H. WAKEMAN.

JUDGING by the crude appliances adopted in some cases for the support of steam pipes of various sizes, some engineers and owners of plants are doubtless not aware of the great variety of devices which combine convenience of application, flexibility of adjustment and strength of material that can be secured at reasonable cost in the open market. The object of this article is to describe these, showing the different styles and offering suggestions and recommendations concern

ing their use which should prove beneficial to those who erect and operate steam plants of every kind, and for all purposes.

Fig. 1 illustrates the most simple kind of pipe-hanger that can be found. It consists of a piece of round wrought iron having a diameter suitable for the strain that is to come upon it in service, and a proper length for the pipe on which it is to be used and the "drop" adopted, or, in other words, the distance between the pipe and the ceiling above it. Each end is then bent nearly into the form of a circle, but not welded, as it has ample strength without this precaution. The rod is then bent into a semi-circle at the center, the radius depending on the diameter of pipe that it is intended to support, and the hanger is finished.



FIGS. 1 AND 2.—SIMPLE PIPE HANGERS.

This kind of hanger is used almost exclusively on the sides of heavy timbers, to which it is fastened by a long screw through each eye. This form of construction seldom fails in service, partly because it does not depend directly on threads of iron holding in wood, for a plain bolt without threads would be almost as safe, provided it was a snug fit in the hole and the bolt was long enough nearly to equal the thickness of the timber. It is absolutely without means of adjustment, either when placing the pipe lines or to compensate for springing of the timber, as more weight is put upon it, or for unequal settling of the building due to insecure foundations.

The hanger shown in Fig. 2 is supported by a lag screw put into a timber which supports the floor above or directly into the floor where the popular form of "mill construction" is adopted. The latter consists of a 4-in. spruce floor laid on timbers and covered by ⅞-in. or thicker flooring of hard pine. An important point to be considered in this connection is the selection of a proper bit for boring the hole to receive the lag screw. The natural tendency of a carpenter is to select a bit that will bore a hole large enough to allow the lag screw to turn easily, thus saving himself more or less hard work; but this should be prohibited as unsafe and unprofitable. The bit should bore a hole that would allow the body of the screw to be driven easily, provided the threads were removed, thus forcing them to cut their way into the wood under actual working conditions and to secure a firm hold.

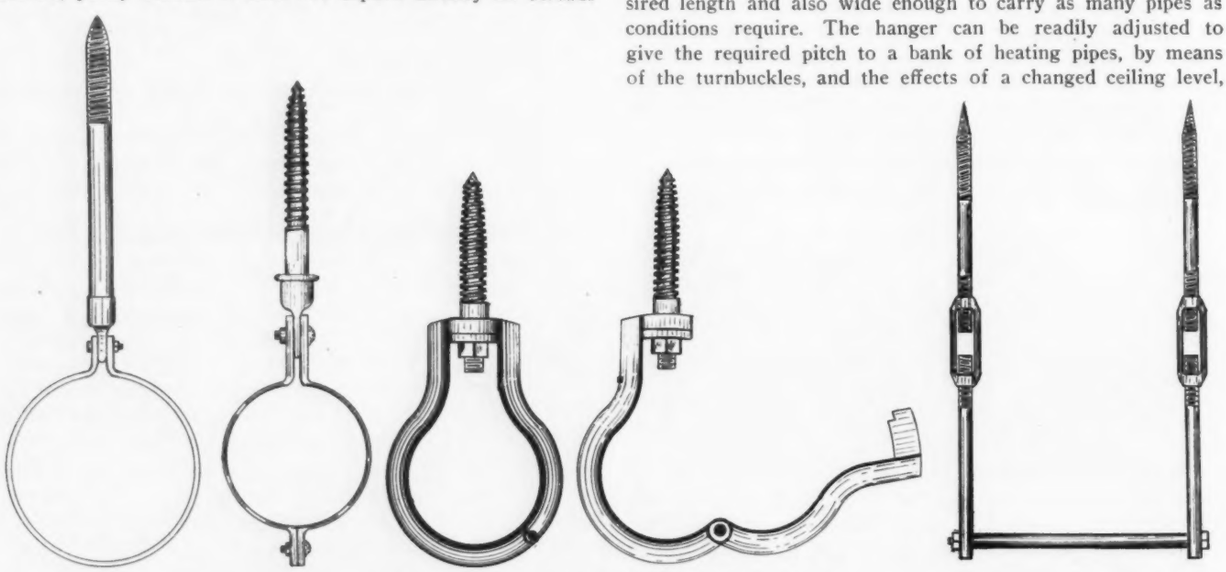
A piece of flat iron is bolted to the flattened head of the lag screw as shown, but, owing to the position of this iron several bolt-holes in it are not visible. If this iron is too long it can easily be cut off with a cold chisel, and the lower bolt may be put in another hole to secure the desired length. The lower bolt is in double shear, therefore it will hold much more than the upper bolt, which is only in single shear.

Fig. 3 illustrates another hanger, the upper part of which consists of a lag screw. All hangers of this class are adjustable to a small extent by turning this screw to the right or to the left. These lag screws have standard iron-pipe sizes, therefore they can be shortened by the use of pipe tools, or lengthened by adding a pipe coupling and a nipple of the desired length.

The two preceding illustrations show bands that are made in one piece which must be opened to clasp the pipe, but Fig. 4 shows a band made in two parts and held together by bolts. The hanger is not as symmetrical as when there is no bolt on the lower side, but it can be put on and taken off with less trouble.

Fig. 5 illustrates a malleable-iron hanger that is galvanized when so ordered. It is hinged at the lower right-hand side and may be opened, as shown in Fig. 6, to be placed on the pipe. When closed it is safe and a nut is provided for raising and lowering the pipe to secure good alignment.

Fig. 7 shows a trapeze hanger that may be made in any desired length and also wide enough to carry as many pipes as conditions require. The hanger can be readily adjusted to give the required pitch to a bank of heating pipes, by means of the turnbuckles, and the effects of a changed ceiling level, due to settling of the building, or depression due to heavy weights on the floor above, can be counteracted at pleasure by the same means.



FIGS. 3 TO 7.—VARIOUS TYPES OF PIPE HANGERS.

Fig. 8 illustrates a solid cast-iron hanger without an adjustable feature. It is strong and durable, but correct calculations must be made in advance of the erection of pipe lines that are to be supported by this style of hanger as mistakes

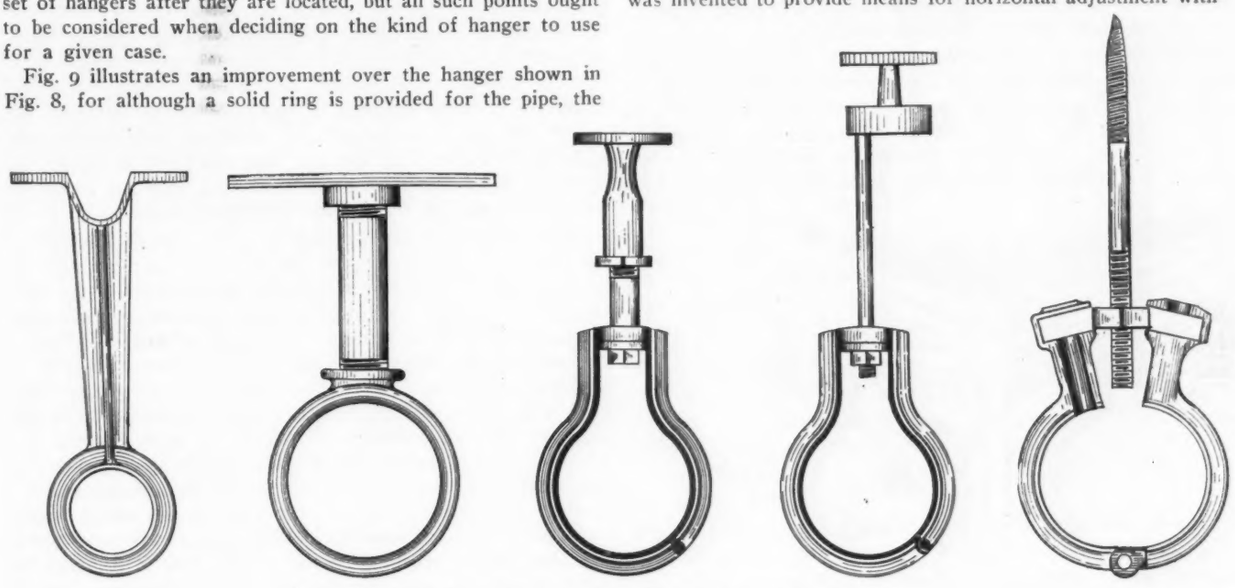
cannot be corrected by changes in lengths of the supports. It is necessary to put the required number of hangers on each length of pipe before fittings are used, and if pitch is desired, provision must be made for it on the supporting timbers. If it becomes necessary to remove the hangers after the pipes have been in use for some time, it will probably be cheaper to break them with a few blows of a hammer and substitute a kind that can be put on and taken off at pleasure than to remove the fittings to make a clear passage to the end of each length of pipe. Of course, it is seldom necessary to remove a set of hangers after they are located, but all such points ought to be considered when deciding on the kind of hanger to use for a given case.

Fig. 9 illustrates an improvement over the hanger shown in Fig. 8, for although a solid ring is provided for the pipe, the connection above is not fixed in the shop where it is made. It consists of a nipple, or short piece of pipe, therefore the owner of a steam plant may order as many rings and plates as he needs to make the required number of hangers, then he can purchase or have made the proper number of nipples, of various lengths to suit his requirements. In all cases where solid rings are used care should be taken to have them large enough to move along the pipe easily, for if they are too small to pass over rough surfaces it will take much time to file or grind them to make an easy fit, but if too large no harm will result.

The hanger can be adjusted vertically as follows: A long thread can be cut on the upper end of the nipple and the hole extends entirely through the plate, or at least it ought to in every case. If the hanger brings the pipe too high or too low with a given adjustment, the bolts or lag screws can be taken out and the plate turned in the proper direction to give the desired pitch to the pipe, and when this is secured the fastenings can be replaced. It may be necessary to bore into the timber to admit the projecting end of the nipple, but that does not represent a long job. If a right-hand thread is cut on one end of the nipple and a left-hand thread on the other end, the pipe can be raised or lowered at pleasure with a pair of pipe tongs. If the plate is fitted with a left-hand thread when manufactured, there is no good reason why it should cost more, therefore, it only requires foresight in the matter to secure a more convenient hanger. A left-hand pipe tap can be inserted in a right-hand thread and run down to a suitable depth without injury to the first thread. It is then possible to screw in either a right or left-hand nipple at pleasure, making a joint that is satisfactory for this kind of work. Of course, these adjustments can only be made to a limited extent, as calculations are supposed to be made nearly correct when the nipple is ordered.

Fig. 10 illustrates an adjustable hanger with hinged ring and a nut for raising or lowering it. The upper part of this hanger has an anchor that is intended to be built into reinforced concrete work. This popular form of fireproof construction cannot be easily used to support hangers unless provision is made for such service when the work is erected, therefore it becomes necessary to make plans in advance for every hanger to be used. While it is not impossible to locate and fasten these hangers after concrete has set or hardened, it is a thoroughly impractical job, the cost of which is much more than is actuall necessary where complete plans are made in advance.

It is a very easy matter to locate hangers slightly out of their proper position, thus causing a line of pipe to assume a very unsatisfactory appearance, and it is very expensive to correct such a mistake, therefore, the hanger shown in Fig. 11 was invented to provide means for horizontal adjustment without disturbing the anchor. The lower part of this anchor consists of a hollow stationary disk within which is confined another disk that carries the rod. The inner disk can be revolved at pleasure, but will not come out of place in service. The rod that supports the pipe is tapped into this disk about 1 in. from the center, therefore when the latter is given one revolution, the former describes a circle nearly 2 in. in diameter, hence a false alignment can be corrected to the extent of this capacity, or in other words, the hanger can be made to correct an alignment that is out nearly 1 in. either side of the center line.



FIGS. 8 TO 12.—APPLIANCES FOR SUPPORTING PIPES.

FIG. 13.

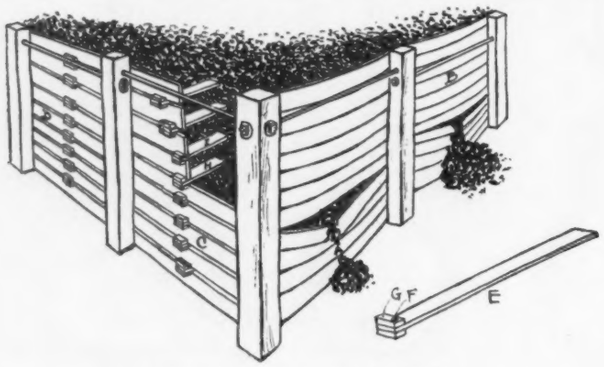
The hanger shown by Fig. 12 consists of a lag screw of suitable length to give the desired "drop" with a thread on the lower end which carries a nut by means of which vertical adjustment can be made to suit varying conditions. The lower part is a ring hinged centrally at the bottom in order that it may be put on and taken off from the pipe at pleasure. The upper part forms a clamp in two parts, which meet around and conceal the nut, as illustrated in Fig. 13, thus forming a very convenient hanger that is strong in service and symmetrical in appearance, especially as the thread is concealed. The upper part of this hanger has an anchor for use in connection with reinforced concrete work.

Hangers that are hinged centrally (see Figs. 12 and 13) make it unnecessary to raise the pipe higher than its finished position requires, whereas the hanger shown by Fig. 10 and others of the same class require the pipe to be lifted higher and lowered into place. However, hangers of the latter type will hold the pipe when the ring is open, which is not true of hangers of the former type. There are no small parts used in connection with these to be mislaid or lost in the disorder which usually attends the erection of a new mill or shop on account of masons, carpenters, machinists, iron workers, plumbers and laborers plying their vocations.

LETTERS ON PRACTICAL SUBJECTS

STORING COAL IN LIMITED SPACE.

In operating central or isolated stations, it is frequently very convenient to be able to utilize a limited floor space for the storage of considerable quantities of granulated material. If coal is to be piled to a considerable height, it becomes a serious problem to confine the material against lateral spread. It is comparatively easy to erect a few timbers, as shown by the accompanying illustration, and place planks *ss*, shown at *a*, *b*, *c* and *d*, to retain the coal or sand. But, unfortunately, the weight and pressure of a body of coal which has been piled 15 ft. or 20 ft. high is more than can be withstood by 2-in. planks 16 ft. between the retaining posts. The invariable result of this kind of engineering is seen at *a* and at *b*, where the planks have been badly sprung outward and some of them broken by the internal coal-pressure.



SUPPORTING COAL-BIN PLANKING.

A very cheap and very complete remedy for the trouble at *s*, and *b*, lies in the little arrangement shown at *e*. It is merely a piece of board, of any convenient length and width, and is found in use from 6 in. to 12 in. wide, and 4 ft. to 15 ft. long. Two short pieces of board are fastened across one end of the board, either by nails, as shown at *g*, or, which is better, by means of a couple of small bolts as shown at *f*. Ordinary carriage bolts will answer the purpose admirably.

The manner in which these supporting strips of board are applied is shown very plainly in the broken-away portion of the engraving at *h*, and *i*, where boards are shown, simply laid into the coal with the planks *c*, engaging the cleats which have been fastened at *f*, *g*, across the boards *c*. It has been found that in wall-supported or confined material, almost exactly one-half the material thus confined is supported by the walls of the bin or tank. Thus, in this case, one-half the weight of the coal is actually carried by the walls. The statement made in the preceding paragraph should be modified by stating that it refers to a storage bin where the depth of the stored material is equal at least to the diameter or width of the bin in which it is stored. The rule would not apply evidently to a bin 1 ft. deep and 100 ft. wide; but for a square or round bin of equal dimensions, the rule applies very closely. Thus, in the case in hand, the material contained in the bin may be considered as being half carried by the planking and the posts and it becomes very easy to tie the planks against being pressed outward by merely placing one of the tie-boards between each pair of planks.

Should the planks be very long between the supporting posts, or should the coal or other material be piled very high, then it may be necessary to place two or perhaps even three boards between each pair of planks. No other fastening is needed to the tie-boards, except to lay them in and pile coal on them. The pressure of the coal, vertically downward, is so great that the tie-boards cannot slip endwise, and the higher the coal is piled the greater will be the downward pressure.

When sand, ashes or other very fine material is to be piled as above noted, it may be necessary to cover the cracks or openings between the planks at *c* and at *d*, to prevent the fine material from flowing out through the cracks between the planks. Very thin boards, placed inside the bin, will answer for this purpose. These thin boards can be removed, one by one, as the bin is emptied and the tie-boards exposed to sight. The tie-boards, and also the planks are to be removed as the bin empties, and, of course, the planks and boards are to be put in place again as the filling proceeds.

No nails or other fastening should be used. Gravity must do it all, and gravity is fully equal to the occasion, provided it is given the opportunity. Care should be taken that the cleats are properly fastened to the ends of the tie-boards *e*, for should these cleats pull off under the severe outward pressure of the coal in the bin, then trouble will result. A couple of bolts should be inserted in each tie-board and then there never will be any trouble from that source.

Boston, Mass. James Francis.

TESTING METERS IN CONSUMER'S PREMISES.

When a meter is tested on a consumer's premises it is made for one of two reasons: As a check to the accuracy and operation of the meter for the central station's benefit, or due to a complaint of a customer. There are many ways of testing these meters; as with a volt and ammeter indicating wattmeter or by a standard rotating set in series with the meter under test.

The volt and ammeter are not desirable as an approximate test is reached, because the fluctuations of voltage due to motors and elevators being on the same circuit, all of which make it hard to get anything but an approximate test. Not only that, but the man making the test has four instruments to watch: A volt and ammeter, stop-watch and meter being tested; consequently he is not sure of the test, and if it is an alternating-current circuit it is not possible to get a correct test unless the exact power factor of the circuit is known. When an indicating wattmeter is used the test is made easier, reducing the number of instruments to be watched and indicating the load in watts directly. But the most modern method is to place a rotating standard portable meter in series with the meter to be tested and by using a standard load box any load can be got and the graphic condition of the meter ascertained. By starting the standard meter at zero, and counting the revolutions of the meter under test, the only instrument to be watched is the one under test, as the standard registers its own revolutions.

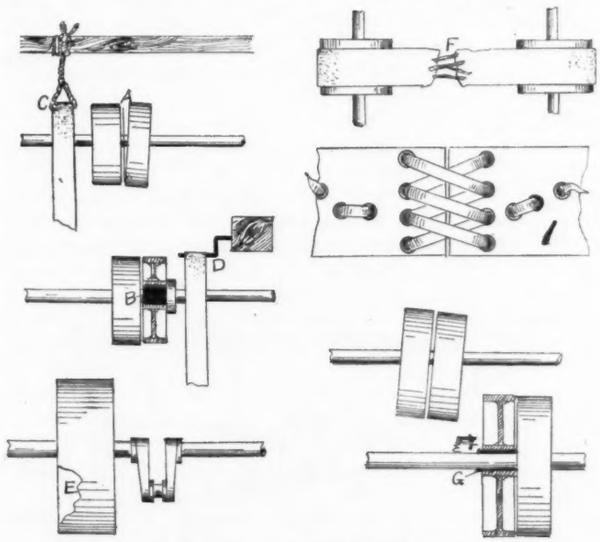
In making the test it is always advisable to place the standard ahead of the meter, because the ratio of energy passing through the standard and regular meter varies. When the standard is placed before, it receives more current by the watt losses in the regular meter; but if behind it receives less, assuming that both meters are of the same capacity. In many modern meters this loss is very low and may be neglected on full load; but as the loss decreases the error becomes greater as the I^2R loss in the field becomes less. On a load of 500 watts the standard meter will receive 4.6 watts more than the meter under test. Therefore, if the customer is watching the test it would appear more to him and make him feel satisfied when he sees his meter running slower than the standard meter. But if the standard is placed behind his meter and during the test he finds that his meter is running faster, due to the causes mentioned above, no amount of explanations will satisfy him that his meter is correct. Then again, if the customer has no technical knowledge of the subject, the graphic method of placing the two meters in series and making a direct comparison will appeal to him more than a lot of ammeters and voltmeters or indicating voltmeters showing the volts, kilowatts, etc., of which he knows nothing. If the meter should be found fast or slow it is good practice to change it and replace it by a meter from stock. Then the faulty meter can be overhauled in the test room, cleaned and recalibrated and the cause for the error located. In cases where meters are found to "creep," the house

wires should be disconnected to see whether the trouble is due to a ground on the installation or is due to the potential coil of the meter. In the above case it is advisable to stop this creeping with the meter in position, by adjusting the light load adjustment screws or by the adjustable shunt field coil. Before the meter tester leaves the premises he should show the consumer how to read his own meter and thus keep "tabs" on the indexer on his monthly round. If, when the meter is found correct and the consumer insists that there is something wrong, and that he has not been using many lamps, it is advisable in this case for the tester to inspect the installation and see whether there are any black, dim lamps on the circuit and if so, to have them renewed. The general policy of the meter department should be to give as perfect meter service as possible, and to maintain harmonious relations with the consumer and the company.

NEWBURGH, N. Y. A. P. BROADHEAD.

DEFECTIVE BELT DRIVES.

Often the best makes of electrical machines are hindered in their mechanical movements by the adverse condition of the belting. Fig. 1 shows the handicap under which a certain electrical motor was compelled to operate. The belt extended from the fly-wheel of the motor to a shafting line overhead, on which the fast and the loose pulleys for the belting were secured. The fast wheel was properly set and firm, but the loose wheel was suffering from a worn hub, with the result that the wheel inclined over at the top, leaving a gap as at *A*. The loose wheel was so arranged that it had to run all the time when not in use. Hence the premature wearing down on both the bearing of the wheel and the shaft at that point. In some places, the wheel is saved from this wear and tear by tieing up the belt, free from the wheels, by means of a rope, as at *C*, when power is not needed. This arrangement not only eases up on the wheel, but gives the belt a needed rest. One cannot get good work from a leather belt that is stretched day after day, and all night, on the wheels. The belt should be given a rest over night and Sunday. In the case of the tilting loose wheel in Fig. 1, the wheel was removed and bored. Then a sleeve was shrunk in to take up the worn part. Next the wheel was replaced as at *B*, in Fig. 2, the darkened portion showing the sleeve, and a metal



FIGS. 1 TO 6.—DEFECTIVE BELT DRIVES.

belt holding hook installed at *D* to hold the belt, instead of the rope. This arrangement proved much better for the wheels, the belt and the electric motor.

In another case, the power derived from a motor was unsteady, and various changes were made to eliminate the defect. Ultimately the balance wheel was found to have lost a certain amount of weight, due to the breaking off of a piece of the rim, as at *E*, Fig. 3. The loss of weight threw the wheel out of balance. The trouble was overcome by shaping a piece of sheet metal to conform with the plan of the rim, after which the piece was riveted in place with inner cleats. The weight being thus balanced, the wheel ran true and even.

In another case it was observed that a first-class electrical driving machine in a printing office was having quite a struggle with a belt which had been permitted to deteriorate to the condition shown at the joint at *F*, Fig. 4. Every time that the defective part of the belt contacted with the pulley rims the belt slipped a little. The loss of force created an unsteady movement. The workmen attributed the trouble to a defective motor, and complained to the makers. The belt sewing was reconstructed on the plan shown in Fig. 5. The entire torn and worn portion of the old joint was cut out. An entire new joint of belting was inserted and laced evenly and firmly like the pattern, after which the motor operated steadily.

Fig. 6 shows the worn and wabbly order in which two wheels were run for a belt connected with a motor in a flour mill. The wheels had become worn at the bores and, in order to take up the worn part some keys had been driven in. However, the keys were not evenly arranged, the result being the tipping of the wheels to one side. The belt, in seeking the high side of the combination, gave trouble by slipping and running off. To remedy the defect the wheels were removed and rebored, so as to make the holes even, and then placed back on the shafting. Four steel keys were used for each, being driven at proper distances apart around the shaft, as at *G*, in Fig. 7, thereby straightening the wheels.

NEW YORK, N. Y. ROBERT GREER.

CONSTRUCTING LAMP-ARCHES FOR STREET LIGHTING.

The lighting of streets by means of arches formed of incandescent lamps must be acknowledged to be a very pleasing, effectual and spectacular method which meets with public approbation wherever it has been tried. With the cost and the efficiency of this method the writer does not wish to deal. It is only with some of the mechanical and electrical methods which may be employed in placing and maintaining the several lamps in their respective positions that the writer desires to take issue. Fig. 1 shows a form of wire arch which answers the purpose, but which is hard to build, slow of construction and a tedious thing to adjust and to keep in shape. But for all that, this arch is frequently met with. To construct the arch, two hook-bolts, *a* and *b*, are first put in position in the buildings or in the poles which are to support the arch. Next, a heavy wire is stretched as shown at *c*, and connected with hook *b* by means of the turn-buckle *d*, through which the catenary of wire *c* is adjusted to suit. Two smaller eye-bolts are inserted at *e* and *f*, and expansion bolts may be used for these, but for the main bolts *a* and *b* through-bolts should always be used. While expansion bolts may hold, they are not to be trusted for work of this character, but they will do

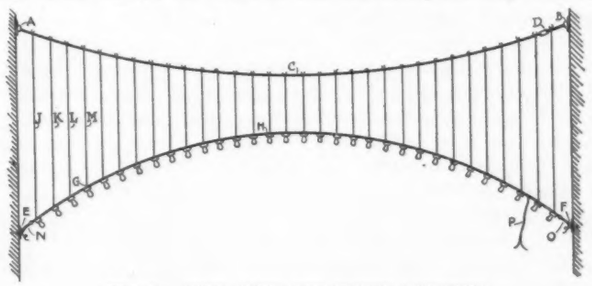


FIG. 1.—WIRE ARCH FOR STREET LIGHTING.

very well for the lesser purpose at *e* and *f*. Next, the feed wires *g*, *h*, *i* should be prepared by attaching lamps at the required distance from each other, and taping thoroughly against the action of rain and snow. If the lamps are to be spaced 1 ft. or 2 ft. apart, the chosen distances should be measured very carefully, and the feed wires and the lamps attached at the stated distance from each other. The feed wires

g, h, i must be of ample length and the excess can be cut off much easier than an extra foot can be added by splicing.

The double wires and their string of lamp sockets should then be hung and fastened temporarily in place by means of cords suspended from the wire *a, b, c.* No. 8 wire, doubled and twisted, makes an excellent support for the arch wires, which in turn support the lamps and feed wires. After the feed wires and the lamp sockets have been put temporarily, or rather approximately, in place, the plain supporting wires *j, k, l, m,* etc., are put in place and adjusted to length after having been attached to the lamp sockets as shown by the engraving, Fig. 1. Upon the manner in which these vertical supporting wires are adjusted depends the smoothness of the lamp-circle. It is possible to give the arch a very smooth and even appearance by carefully adjusting the length of each supporting wire. Indeed, it is best temporarily to fasten each wire until all are in place, then go over them all once or twice and adjust those which hold their respective lamp-sockets too high or too low. Once these wires have been satisfactorily adjusted they may be fastened permanently by

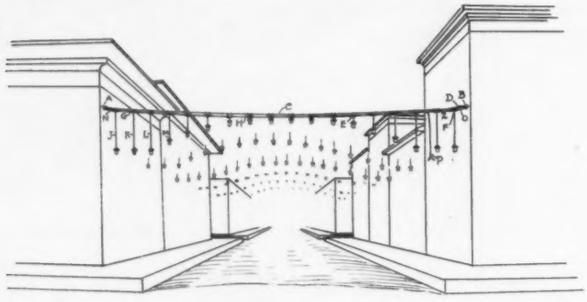


FIG. 2.—"SUSPENDED ARCH" STREET LIGHTING.

twisting them firmly together around the supporting wire as shown in the engraving (Fig. 1) above *a, b, c.*

It will be necessary to fasten the feed-wire in some manner, and this is best done by means of two pieces of No. 16 or No. 12 iron wire, the same as was used for the supporting wires. These bits of wire are shown in place at *n,* and *o,* being attached to the expansion eye-bolts *e,* and *f,* and to two porcelain insulators, one of which is placed upon each end of the feed-wire *g, h, i;* the latter wire passes through the insulator, while the iron fastening wire is twisted around the insulator in the usual way. There now only remains the attaching of the connection to the line wires from which energy is to be taken. This is effected by means of the double wire *p,* which is spliced to the feed-wires and the free ends connected to the proper lighting circuit wires, which may be hung upon poles.

The arch above described, while it may prove satisfactory for some purposes, is not convenient to install, neither is it as weatherproof as may be desired. There are so many taped connections for water to leak into, and so many supporting connections to adjust, that other forms of lighting-arches have been found more desirable. The arch represented by Fig. 2 is constructed upon an entirely different plan from that shown by the preceding engraving. Instead of four points of attachment to walls or poles, there are only two, thus lessening the construction cost considerably. The suspension wires which keep the arch in shape are also dispensed with and the number of lamps necessary has been greatly lessened by using some form of high-power lamp which is fitted into an umbrella-socket particularly adapted to outdoor use, and in which the double feed wire is introduced and specially sealed against weather and water. It is now possible to hang each lamp from a vertical wire, the length of which shall govern the position in the arch of the particular lamp to which that wire may be attached. This is very plainly shown in Fig. 2, where the 18 lamps which are spaced across the street in each arch are arranged in groups of three.

Above each sidewalk three lamps hang upon a level. The next three lamps ascend sharply in a curve approximating the quick curve of a parabola. The next three lamps reach to the center of the street and coincide with the flat reach of the parabola. The three lamps last mentioned, being adjacent to the three similarly placed lamps on the other side of the street, present the flat effect which makes the appearance of this arch so much more striking than the one shown by Fig. 1. As rather

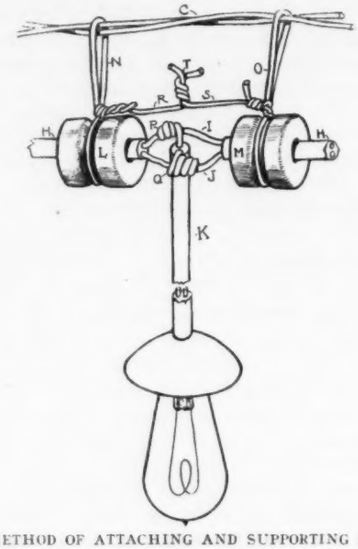


FIG. 3.—METHOD OF ATTACHING AND SUPPORTING LAMP LEADS.

crudely shown by Fig. 2, this peculiar arrangement of the arches and of the lamps gives an exceedingly pleasing effect to the perspective of the arches. There is not that exasperating sameness to this arch that there always is to the circular arch which breaks straight across the street without relief or change of curve from beginning to end.

This arch also presents very much less resistance to wind than does the arch shown by Fig. 1. As only one end of each lamp-supporting wire is fixed, the wind pressure will be relieved to a considerable extent by the swinging of each lamp in the direction of the wind. Thus, each lamp can yield independently to heavy gusts of wind, thereby placing much less strain upon the supporting wires than if the whole arrangement were fixed at four points instead of two. Another valuable feature of the arch shown by Fig. 2 is that the entire construction can be completed upon the ground, in the shop in fact, and erected in a very few minutes, with little adjustment necessary after the design has been put in place upon the supporting wire or cable. A doubled and twisted No. 8 wire answers well for this purpose and it is fastened in place exactly as described for the cable in Fig. 1. This wire is indicated by the same letter, *c,* in both engravings, the hook-bolts by *a* and *b,* the turn-buckle by *d,* etc. The feed wires, *g, h, i,* are connected with drop wires to the lamp sockets, and

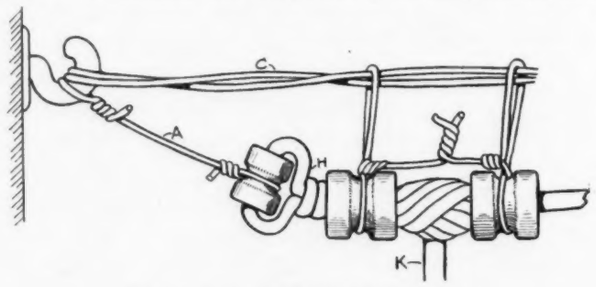


FIG. 4.—METHOD OF ANCHORING ARCH.

are shown at *j, k, l, m,* etc. To center this arrangement of wiring two pieces of lashing wire are provided as shown at *n* and *o,* and the feed wires are made fast to the hook-bolts *a* and *b,* porcelain insulators being used for this purpose.

The manner in which the wiring is connected up may better be understood by reference to Fig. 3, which represents a detail

of the wiring at *e*, upon a larger scale than can be shown by Fig. 2. In this engraving the twisted supporting wire is shown at *c*, the feed wire at *h*, *h*, and the double wire lamp feeder is shown at *k*. The feed wire *h* is laid bare at *i* and *j*, and the drop wire *k* (which is the same as double wire *h*) is also bared of its insulation and connected to *h*, as shown at *p* and *q*. The entire connection is then well taped to exclude the weather, after which the porcelain insulators *l* and *m* are brought close up against the taping, which is not shown by the engraving, after which, the insulators are fastened together and to the supporting wire, as shown by the lashing wires *n* and *o*. The free ends of wires *n* and *o* are twisted together so as to hug the insulators very closely, also to leave the loops which pass over the supporting wire as shown. When these are made up in quantity, a little machine may be used to advantage; just a little hand machine, jig, or tool, consisting of a piece of metal to fit inside the loop *o*. In fact, this loop, and the one at *n* may be quickly formed by putting an insulator on a pin or headless spike projecting from a bench or post, then applying the wire in a loop and using the hand jig for twisting together the free ends of the wire, leaving the loop of exactly the size required.

The ends of the loop wires, after having been twisted together, should be left with one of the wires projecting as at *r* and *s*, while the other end is cut close as shown. One of the insulators must be put in place on the double feed-wire *h* before the joint *i*, *j*, *p*, *q* is made and taped, after which, the other insulator should be brought as close to the joint as the taping will allow and the wire ends *r*, *s* twisted together as shown at *t*. This effectually prevents any sidewise movement of the insulators *l* and *m*, after the loops *n* and *o* have been slipped upon the supporting wire or cable *c*. For clearness, most of the wire-ends shown in the engravings have been left projecting into space, but the wireman will take care that none of these wire ends are left to punch holes in the insulation.

The entire assemblage of insulators, drop wires, loops and feed wire may thus be assembled and strung upon the supporting wire after the length of the latter has been determined and cut. The through eye-bolts may be located in a variety of ways. An engineer with his telescope level may be employed to give the proper height at which each bolt is drilled into the building or pole, or, if the sidewalk is on the grade, a piece of wood may be used for measuring directly the height of each hole from the sidewalk directly underneath. When the sidewalk is not to be depended upon a couple of horizontal sight-boards or targets can be arranged at distances of several streets from each other, and a pole used which will just reach from the top of the target to the bolt holes in the walls; then sight over the targets and have the pole adjusted until its lower end is exactly in line with the face of each target. The bolt holes may then be marked at the top of the pole.

After the hook-bolts are in place and screwed up, with ornamental washers to conceal the ragged drill work in the walls, the supporting cable may be stretched with its load of feed-wire and insulators, drop wires and umbrella lamp sockets. The turn buckle may then be adjusted until the catenary of the supporting cable appears about right, when the ends of the feed wire may be tied to the hook-bolts temporarily with strings and the lamp wires and sockets made hang evenly and where they are expected to appear. Each arch should be in proper alignment and level with the other arches, and the turnbuckle and the temporary lashings adjusted until the arches are straightened out to suit. The temporary cord lashings may then be replaced by permanent wire fastenings, as shown by Fig. 4, in which *a* represents the permanent wire lashing, and the manner of its application is so plainly shown that no further description is necessary.

The manner of applying the small porcelain insulator at the end of the feed wire is also plainly shown, likewise the manner in which the larger porcelain insulators are brought against the taped joint and fastened there by the free ends of the loop wires which engage the supporting cable. The wire leading to the source of electrical supply is connected in exactly the same manner as that illustrated for attaching the lamp or drop wires. Taken altogether, this arrangement of street arch lamps forms a very inexpensive as well as a very effective method of obtaining a full arch effect in the illumination, without the expense of one cent for ground work.

Occasionally it is necessary to support arches of this character upon poles or posts. This form of support should be avoided entirely, whenever possible, for the eye-bolt or hook attached to a solid wall forms a much more rigid support than is possible with pole construction. However, if absolutely necessary, pole construction can be made to answer very well, but there is often considerable expense met with in strengthening the pole line with the necessary guys.

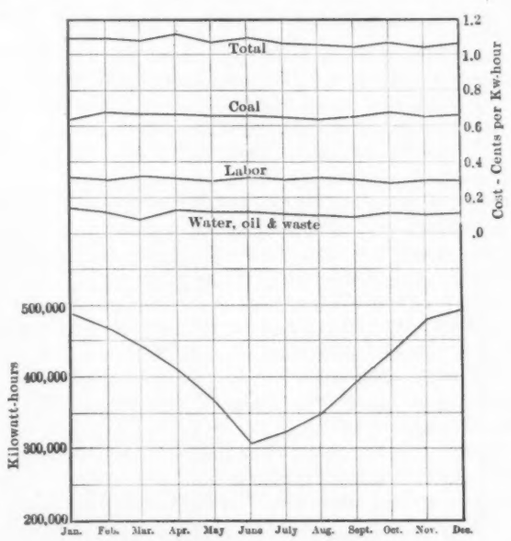
WILLOUGHBY, OHIO. JAMES F. HOBART.

HANDY CENTRAL-STATION CHART.

In a recent issue an article by W. F. Kimball illustrates and explains a "Handy Central-Station Chart." To find the cost of any item, using Mr. Kimball's chart, it is necessary to follow up from the month to the line indicating the load for that month, thence along the horizontal line to a symbol denoting the commodity whose cost it is desired to ascertain. It is also evident that since the high or low loads may come for any month, they may have any relative position in the line of costs—that is, they are not necessarily related in any logical way to those next above or below. It may frequently happen that two or more months may have the same coal cost per kw-hour, for the same load, necessitating the superposing of symbols.

If an ordinary cross-section sheet be arranged as shown by accompanying sheet, it is possible, without going first to the load value, to find the cost per kw-hour of any item for any month by merely following the heavy vertical lines. Further, the load now takes the familiar "load-curve" shape.

A glance then serves to show whether or not the total cost per kw-hour is rising and falling with the load, or what items



CENTRAL STATION CHART.

are. For example, the curves shown indicate that the cost of coal per kw-hour is not proportional to the load factor, but for the given year is nearly independent of the output.

The values used are the same as used in Mr. Kimball's chart. For values of the different items, which differ somewhat, as shown here, no symbols need be used and where items have nearly the same values, the familiar, solid, dashed, dot-and-dashed or dashed and double-dotted lines offer a simple solution.

These curves could also be drawn with the value for each month as a horizontal line taking one full division, with vertical connecting straight lines, but this would require more time without adding any to the clearness.

NEW YORK, N. Y. R. W. KNOWLES.

QUESTIONS AND ANSWERS

What acid is used for cleaning the inner globes of arc lamps? M. F.

For light deposits dilute hydrofluoric acid is used; but when the deposit has been burned into the glass the hydrofluoric acid is used undiluted. Inasmuch as the acid dissolves the glass, repeated washings weaken the globe so that liability of breakage or fracture is increased.

In ordinary line work, should soft-drawn or hard-drawn copper be employed? D. L.

For ordinary work many engineers prefer the soft-drawn copper, claiming that the disadvantage due to increase of sag is more than offset by the difficulties in handling hard-drawn wire and the possibilities of damaging the latter when it is being erected.

Is there any danger attached to the use of small quantities of electricity at a potential of 10 volts? J. F. G.

No. It is doubtful if electricity at this potential can be detected by shock except by bringing both wires of the circuit to the moistened tongue. An average person under very favorable conditions does not experience any sensation whatever until the tension reaches about 35 volts.

Which is the preferable way to place cross-arms on long runs, and why? E. T. N.

On long, straight runs it is advisable to set the cross-arms in such a way that they alternately face each other on adjacent poles and are back to back on the next two poles. In this way should a stretch be cut down or a pole break, there is less danger of the cross-arms being wrenched off than if they were all set in the one direction.

How are the oscillators attached to the shafts of rotary converters operated?

An instrument which automatically closes the circuits to the electromagnet fastened to the commutator-end of the dynamo frame directly across the end of the armature shaft, is mounted upon the wall or upon a switchboard most convenient to the machine. This instrument consists of an electromagnet with a vertical plunger at the other end of which a dash-pot is attached. About the center of this plunger shaft two washers are fixed to limit the play of a lever having balance weights at one end and a carbon contact at the other end. The carbon contact piece is adjusted to strike another carbon contact piece fixed to the board. When both carbons come together the circuit is completed and the impulse in the electromagnets upon the machine attracts the armature shaft. Instantly the magnet of the oscillator instrument attracts its core and the washer lifts the carbon-tipped lever, thus opening the circuit. The core then descends again under the action of gravity, its motion being regulated by the dash-pot at the other end. The carbon-tipped lever is carried down with it until the carbons are again in contact when the movement is again repeated.

When would it be advisable to use an induction motor and when a synchronous motor? What advantage does one possess over the other? W. S. B.

Where a motor must start with full-load torque, an induction motor must be employed. Where the conditions are such that a motor starts light and receives its full load after having come up to full speed, then either the synchronous or the induction motor may be used. The synchronous motor has the advantage that its power factor is adjustable and can be made to suit the requirements of a transmission system, whereas the induction motor has a definite and lower power factor that is constant for a given load. Synchronous motors commonly start with reactances in their armature circuits sufficient to keep the starting current down to a value not greater than 50 per cent full-load current. Induction motors starting under light load and employing short-circuited secondaries, are commonly started by devices for decreasing the voltage and inserted in the main circuit for the purpose of keeping down the starting current to a little more than full-load current. (See article on rheostatic starters for induction motors by Dr. B. F. Bailey in the January number.) Either motor will come to a standstill if overloaded beyond a certain limit. In that event the only difference is that the induction motor can recover, whereas the synchronous motor will have to be started afresh.

I have been informed that in some of the hydro-electric plants in the West induction motors are attached directly to the turbines driving the exciters and perform some function automatically. This function I have been unable to ascertain and would be obliged for any information on the subject. G. M. B.

Exciters driven from main waterwheel generators are open to the objection that any drop in speed of the main generators causes the exciters to drop in voltage and thus in turn lower the voltage delivered by the generator exactly at a time when increased voltage, if anything, is required. On the other hand, when the exciters are driven by independent waterwheels, as is usually done, there is some liability that the small nozzles employed on the small waterwheels driving the exciters will be clogged. That is, there is more danger of this in the smaller wheels than in the larger wheels driving the main generators. In one of the large power houses of which we have knowledge a 50-hp exciter is driven by a 50-hp impulse wheel. Coupled directly to the other end of the waterwheel shaft is a 50-hp induction motor. This motor is connected to the 2400-volt busbars of the station. The waterwheel of the exciter is run with its valve open as for full load at all times. When less than full load is on the exciter, the induction motor acts as a generator delivering energy to the main busbars. If the water supply for any reason is interrupted on the exciter waterwheel, the induction motor drives the exciter as if nothing had happened.

In protecting against lightning, what part do choke coils play, and how often are they installed? Does barb wire protect, and, if so, what is the best way to fasten it to the poles? O. C.

Owing to the fact that any inductance in the line offers considerable resistance to the passage of a lightning discharge, choke coils are sometimes introduced in series with the line between the arrester and the central station, the combination of arresters and choke coils forming a reliable means of protecting the apparatus in the station. It is not general practice to install a choke coil in conjunction with every arrester placed on the line, owing to the high cost which would be involved. However, it is well to place such a combination to protect any large and expensive apparatus connected to the circuits. The choke coils are usually constructed of flat copper strip wound on a non-inductive core, the layers being insulated with mica or some other substance. Any self-induction in the way of coils or turns in the ground wire of an arrester should be avoided and when the arresters are being installed it is well to watch the linemen, as it is a favorite trick to take up any slack in the wire by making a little coil. Any such coils would be nothing more or less than choke coils, which would completely offset the value of the arrester. The ground wire is a very important feature in the installation of a lightning arrester. Owing to the somewhat uncertain action of lightning arresters barb wire has been used on transmission circuits as a protection against lightning and the results obtained have demonstrated that in many cases it is a most satisfactory means of protection. The barb wire is usually strung on pins on top of the poles and sometimes also at the ends of the top cross-arm. In some cases special two-pin cross-arms have been used above the line wires to carry the barb wires and in other places a single line of barb wire is strung on top of the pole. Experience has shown that it is advisable to fasten the barb wire to glass insulators on pins rather than to staple it to the pole, owing to the superior mechanical support, the insulator, of course, not being used for insulating purposes. Where the wire is simply stapled to the pole, rust sets in at the joint with the staple and the wire eventually breaks. Some engineers consider that the trouble caused by using barb wire offsets its value as a protective device and for that reason its use has been abandoned in some instances.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Vehicles in Indianapolis.

There are said to be about 160 electric vehicles in operation in the city of Indianapolis, Ind., although the conditions in that city are not particularly favorable to electric vehicle development. While the city is level and has many well-paved streets, it lacks good approaches to the parks. The central-station companies have encouraged the business by giving a low rate for automobile charging, but have made no special effort to develop this class of business. The Indianapolis Light & Heat Company, which furnishes service over the entire city, gives a rate of 5 cents per kw-hour on vehicle charging. The People's Light & Heat Company, which operates a central station in the northern residence portion of the city where most of the electric automobiles are kept, offers a rate of 6 cents per kw-hour. Apparently none of the garages has made special effort to cultivate the electric vehicle business. The fact that the Waverly Electric Vehicle factory is located at Indianapolis, of course, has been conducive to greater use of the vehicle.

Development of the Electric Vehicle Business at Toledo, Ohio.

It is well recognized that in most cities the electric vehicle business is but an insignificant part of the total automobile business and, in fact, the electric automobile has too often been looked upon by garage operators as hardly worth bothering with. It has also been looked upon by some electric light and power companies as not being worth much effort to develop because of the sentiment in favor of gasoline machines.

The situation at Toledo, Ohio, as regards electric vehicles is in strong contrast to this. Here we find in a city of 160,000 inhabitants between 400 and 500 electric automobiles in use. There are nine public garages which house, charge and repair

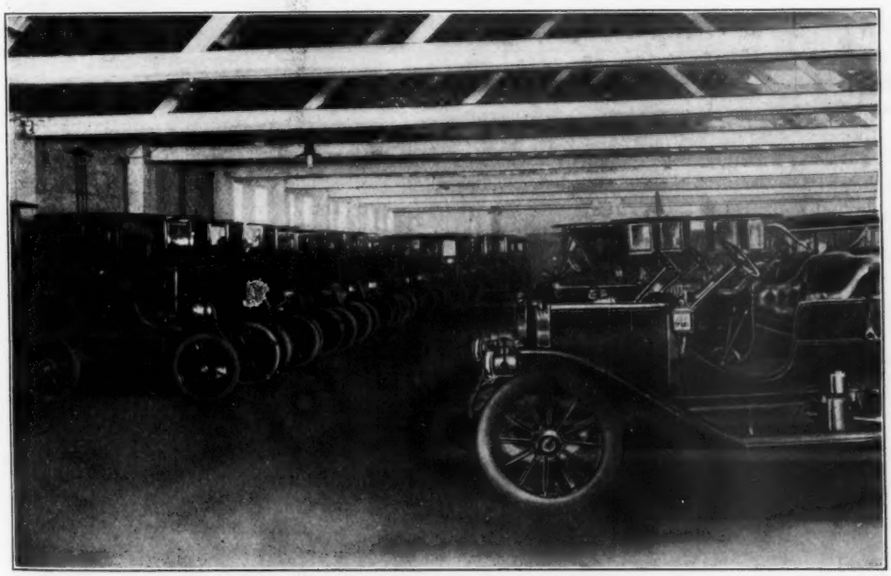


FIG. 1.—ATWOOD'S GARAGE, IN TOLEDO, OHIO.

electric vehicles, and there are 85 private garages where owners house and charge their own electric vehicles. One dealer alone has sold 25 electric vehicles since the beginning of the present winter.

There are several reasons for this unusual development of the electric vehicle in Toledo, but many of them are due to conditions which are, or can be, duplicated elsewhere. The city is level and has well-paved streets. It is also a size favorable to electric vehicle development, because an owner in driving about the city seldom would wish to exceed the available mileage offered by his storage batteries. In a larger city conditions might not be quite so favorable, although as regards

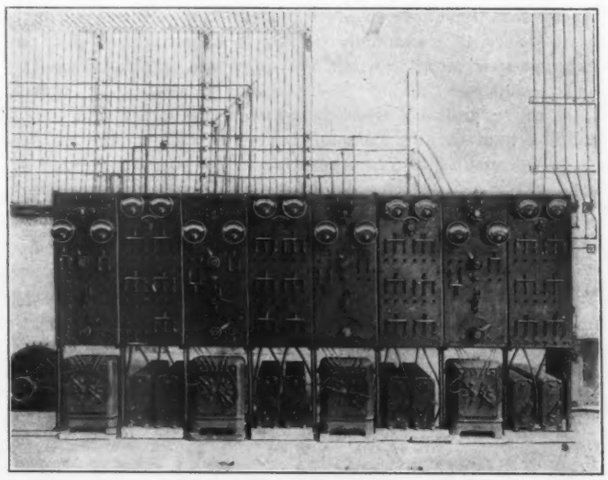


FIG. 2.—SWITCHBOARD AND MERCURY-RECTIFIER CHARGING OUTFIT, TWENTY-FIRST STREET GARAGE.

city use, the importance of large mileage upon one charge has always been considerably exaggerated in the popular mind. The other two essential elements that have built up the electric vehicle business in Toledo are low rates for vehicle charging offered by the Toledo Railways & Light Company and the excellent organization maintained by various garages for properly maintaining electric vehicles. These two essential elements have been lacking in a number of cities where conditions have otherwise been favorable. It is an important addition to central-station load, and for that reason all central-station companies should give this business every reasonable encouragement.

To the casual observer on the streets of Toledo the electric vehicle is much more in evidence than any other kind. It is used continually for running about town, and is frequently used for short trips for which a gasoline machine would not be taken from the garage. A large number of these machines are used by ladies. An afternoon reception in the best residence district will always bring a long line of electric automobiles to the neighborhood. A good show at one of the best theaters causes a line-up of 40 or 50 electric vehicles, the owners simply driving them downtown and leaving them until after the theater, no chauffeur being necessary.

RATES AND CENTRAL-STATION POLICY.

The Toledo Railways & Light Company makes a rate of 3 cents per kw-hour to all public automobile garages and repair

shops. Mr. T. D. Buckwell, contract agent of the company, considers this excellent business, even at this low price, because most of the charging is done after the lighting load goes off in the evening, but a very small part coming on the lighting peak. The rate to private garages is 5 cents per kw-hour, with a minimum bill of $3 per month. As conditions have been in the past in Toledo before recent consolidations took place, direct current was available to a large number of the residents where there were private garages. Direct current is gradually being displaced, however, and owners are putting in mercury-vapor rectifier sets for charging from single-phase alternating current.

While the expense of the rectifier is objected to at first by owners who have heretofore charged their vehicles through $25 rheostats, it is gradually coming to be recognized that the mercury-vapor outfit is worth the difference in price from the owner's standpoint alone. The changing to alternating current is, therefore, desirable from the owner's standpoint, and is not simply a gain for the company. The mercury-vapor rectifier is said to cause an average reduction in kw-hours consumed of about 40 per cent, as compared with charging through a rheostat. The rectifier does away with the necessity of wasting energy in a rheostat, and has another advantage in that it will cut itself out automatically through the extinguishing of the discharge when the battery voltage has risen to a point corresponding to full charge, provided the battery is in good condition. Should the battery not be in good condition, and the voltage thus not rise to the proper point, this, of course, would not occur. The automatic cut-out feature makes it unnecessary for the owner or his employees to watch the battery to prevent overcharge, and incidentally it probably saves considerable overcharging which will inevitably occur with a rheostat having no automatic cut-out feature.

The central-station company sells a mercury-rectifier set installed at $230 for the 20-amp rectifier and $250 for the 30-amp. A reduction of $20 from these prices is made when the owner installs the rectifier. The company, when it takes an order for a rectifier, employs a contractor or interior wireman to make the installation under company supervision, as the company does no interior wiring whatever. So far 25 rectifiers have been installed in private garages and a number in public garages. The income to the central-station company is in the neighborhood of $48 per year per vehicle in use in the city. Of course, some vehicles run far above this and others are used but little. Most of the vehicles are of the type which can be enclosed in the winter so that they are used the year around.

The rectifiers are connected across the regular 220-volt secondaries of the three-wire secondary system in the residence district. No attempt is made to specify the hours during which charging shall be done so as to keep it off the peak. This usually takes care of itself.

PUBLIC GARAGES AND BATTERY MAINTENANCE.

There are nine public garages in the city which keep, maintain and repair electric vehicles, two of which are notable on account of their size and the completeness of their equipment. The central-station income from the largest garage averages $450 per month.

The Atwood garage, at Monroe and Bancroft Streets, "boards" about 120 electric vehicles. The provisions for charging and repair are very complete, the management being in the hands of men who are storage-battery experts. This garage has facilities for charging 48 vehicles at one time. Under proper management, from 60 to 75 vehicles are charged in a night, as few of the batteries are completely discharged when the vehicles are brought in. This, however, is only a little over half the total number kept at the garage, so that there is a large percentage not charged every night. Thus the "diversity factor," which plays such an important part in central-station motor load, also figures in the electric vehicle business and makes it possible to board a much larger number of vehicles than can be charged in one night. In this garage the rate for keeping, charging batteries, washing and delivering an electric coupé is $22.50 per month. In connection with this contract there is a system in vogue whereby unnecessary charging and washing of vehicles is eliminated. It is obvious that too frequent washing of a vehicle is hard on the finish.

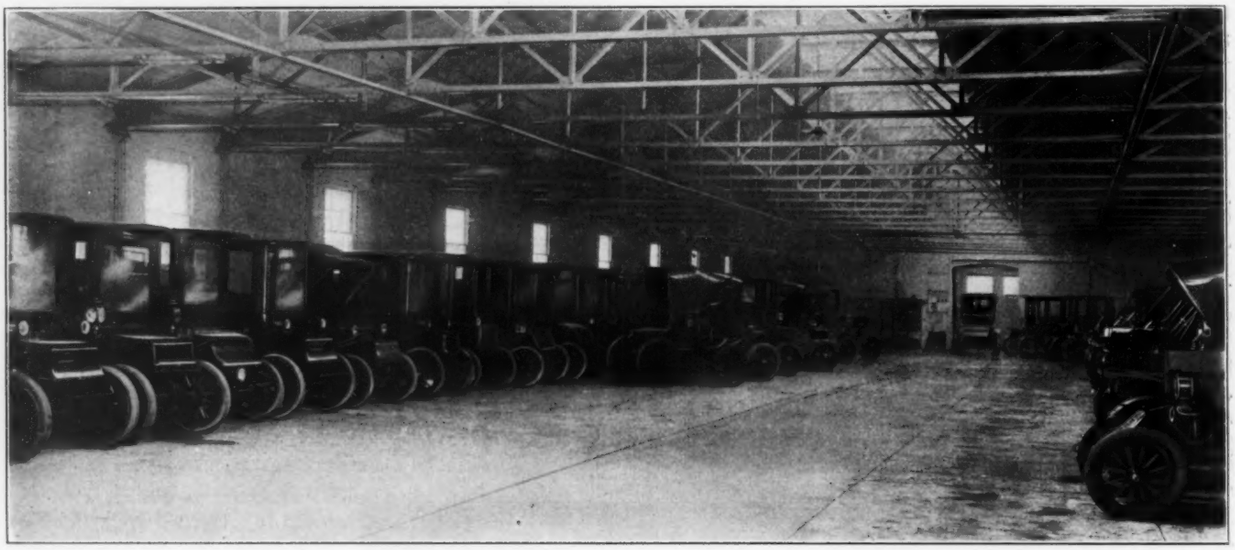


FIG. 3.—TWENTY-FIRST STREET GARAGE FOR ELECTRICAL VEHICLES.

It is also coming to be accepted among electric vehicle battery men that too frequent charging is not conducive to the best life of a battery, although this is exactly contrary to the teachings and practices of storage-battery men 10 years ago. Experience seems to indicate that it is better to allow a battery to be fully discharged down to a certain point each time rather than to discharge it practically each day and completely charge it every night. In ordinary garage practice where the owner gives no instructions, it is, of course, necessary to charge up the battery fully every night, because nothing is known of the plans of the owner for the following day. To obviate unnecessary washing and unnecessary charging, owners are supplied with "Don't wash" and "Don't charge" cards. Whenever the owner knows that he has run a vehicle such a short mileage in a day that he will be able to get through the following day without a charge, he can leave a "Don't charge" card on his vehicle when he sends it to the garage. This practically tends to improve the life of the battery, as the garage records show

that batteries treated this way seem to last longer than those which are fully charged every night.

Another form of maintenance contract is offered by this garage as the result of its experience with electric vehicle batteries, and it is very instructive as to the average cost of maintaining such batteries. The Atwood garage will make a contract with any electric vehicle owner whose rig is new or has been thoroughly overhauled to maintain it and renew batteries for $600 per year or $50 per month. This includes renewals of batteries when necessary and all ordinary repairs on the vehicle, but does not include the ordinary depreciation caused by age and use, or repairs necessitated by accident or collisions.

It is the practice at this garage to examine batteries with a view to the necessity of washing the loose, active material out of the bottoms of the cells after the vehicle has been run a definite number of miles. When this mileage has been made the battery is examined, and if washing out is necessary the owner is notified. The regular charge of $22.50 per month does not cover the battery washing out. By the time a second washing out is necessary the plates are usually so far gone that it does not pay to replace them after the second washing. By that time the plates are usually reduced in capacity so that only about 40 per cent of the original mileage is obtainable, so a second washing is only recommended as a means of tiding over a brief period to the end of a season, or in case the owner is about to sell.

At this garage the charging is done by direct current supplied from a motor-generator set driven by a three-phase induction motor. The rheostat and switchboard panels have two single-pole switches for each charging circuit, one of which is connected through an ammeter at the top of the panel and the other of which leaves out the ammeter. Any circuit can be connected to the ammeter at a moment's notice and then cut out so that the ammeter can be used on other circuits. Each circuit also has a push button connecting to a voltmeter on the board. This garage has a machine shop and battery room in connection. The main floor has ample width to provide for the easy movement of vehicles to and from the charging plugs, which is essential to the rapid and economical handling of vehicles.

The Twenty-first Street garage, under the management of Mr. L. L. Blood, is another large, well-equipped plant. It occupies a fireproof building, 60 ft. x 220 ft., all of which will be given over to the electric vehicle business the coming season, although at present gasoline vehicles are kept in the same space.

The charging at this garage is entirely through mercury-vapor rectifiers. There are eight rectifier panels, giving a total charging capacity of 24 vehicles at once. Two more panels are soon to be ordered. There are about 80 electric vehicles on the regular boarding list at this garage. The rates are $20 per month for cleaning, delivering and charging an open rig, and $22.50 for closed. In maintaining batteries at this garage it is the practice to examine the cells as to any necessity of cleaning out after about five months' use, and notify the owner if such cleaning is needed.

Local Option and Central-Station Revenue.

Some small central-station companies located in towns which formerly had saloons, but which have suddenly gone "dry" at a local option election, have in the past year suffered some embarrassment by a sudden reduction of revenues. This has not been due so much to the revenue obtained directly from the saloons themselves as to the fact that the saloons were operating under license, and that the city was partially dependent on these licenses with which to pay for street lighting. These things are sure to adjust themselves in time, but until such readjustment of the city's finances takes place it is rather embarrassing for some central-station companies.

A discussion by various central-station men as to whether a "wet" or "dry" town is best in which to operate a central-station would doubtless be interesting. As regards revenue traceable directly to the presence of saloons in a community, we surmise the advocate of the "wet" town would probably have the best of the argument. The saloons themselves are almost invariably liberal users of light over longer hours than any other lighting consumer, except the all-night restaurant. If considerable revenue is derived by the city from saloon licenses it helps swell the amount available for street lighting. These sound like reasonable arguments, but on the other hand it is maintained that as far as street lighting revenue is concerned the city with prosperous and steady workingmen, who own their own homes, and where there is a steady revenue from direct taxation, is a safer and sounder proposition for the central-station company than a city with a roving, irresponsible class of workmen where much revenue is obtained from saloon licenses, with the ever-present possibility that this revenue will be interfered with by legislation. The opportunities for securing large numbers of residence customers are also much better in a town where there are few or no saloons, because the working people have more money available for electric lighting and similar conveniences. As regards the revenue obtained directly from saloons for lighting this is partially counterbalanced by revenue from other places of amusement if saloons are prohibited. The saloonkeeper as a customer is generally recognized as the one who will bear the closest watching and the one who is most likely to cheat a central-station company if he gets a chance. A considerable percentage of thefts of current and attempts to tamper with meters occur in saloons. Taking it all together, therefore, the central-station company which is operating in a "dry" town has no reason to envy its neighbor which is operating in a "wet" town.

Increasing Business Among Photographers.

A small field for the sale of electricity which is worth looking up by central-station companies in all cities is that of the use of mercury-vapor lamps by photographers. This lamp has, of course, been used for some time in photograph galleries where portraits are made at night. It is only recently, however, that the advantages offered by the mercury-vapor lamp have been appreciated by photographers in general. The ordinary photographer has been inclined to argue that daylight is free and electric light costs money; therefore, why use electric light of any kind when one can get along with daylight during the best part of the business hours? This reasoning, however, overlooks the fact that it is desirable in making children's portraits, and in some of the best class of work with adults, to take instantaneous pictures. The desirability of the instantaneous feature is apparent to anyone who has ever tried to make children's portraits, and there are many adults whose natural expressions are considerably changed when required to "pose" for a picture. Instantaneous work requires more daylight than can ordinarily be obtained in a studio. A photographer in the down-town district of Chicago recently installed four mercury-vapor lamps in his studio so as to make instantaneous pictures possible. Some of the results he obtained were so fine that there seems to have been a general stampede among the more progressive photographers in Chicago to make similar installations.

From the central-station company's standpoint this is a small but very desirable class of business. It is mainly a day load. Some photographers may be induced by the possibilities of the mercury-vapor lamp to keep open evenings, but even if that should be the result, the load offered by this class of business would be better than the ordinary lighting load, because it would extend also over daylight hours.

The use of such lamps also for printing of photographs makes it possible to turn out work much more promptly in dark, cloudy weather, and, if necessary, printing can be done at night as well as by day. One advantage of printing by a mercury-vapor light and shutting out daylight altogether is that the vapor lamp is always of practically the same intensity, whereas daylight varies greatly according to the time of day and cloudiness. This being the case, it should not be necessary to watch the work so closely while printing is going on. Every

town large enough to have an electric-light plant has one or more photographers, and it seems worth while for both large and small companies to look up this business.

Energy Consumption of Various Types of Incandescent Lamps.

The salesman or solicitor oftentimes experiences difficulty in explaining to the satisfaction of a prospective customer or to a patron of the electric light company the relative advantages of the various types of incandescent lamps now in use. The

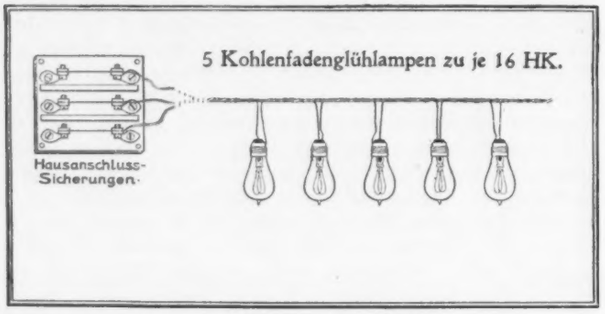


FIG. 1.—CARBON-FILAMENT LAMPS.

one advantage which appeals to the user of lamps is the energy consumption of the lamp for the light given. The accompanying illustrations, reproduced from the bulletin of the Berlin Electricity Works, are intended to convey to the mind of a prospective purchaser of electrical energy the economy of the three types of lamp now in common use in the German metropolis.

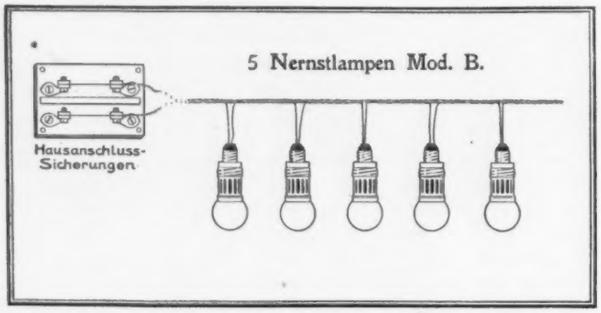


FIG. 2.—NERNST LAMPS

The carbon-filament lamp, the Nernst lamp and the tungsten lamp are chosen for comparison without regard to the cost of each. The lamps are assumed to consume a certain definite fraction of a kilowatt of power. If five carbon-filament lamps giving 16 hefner candles consume this definite amount of power, then for the same energy cost five Nernst lamps giving

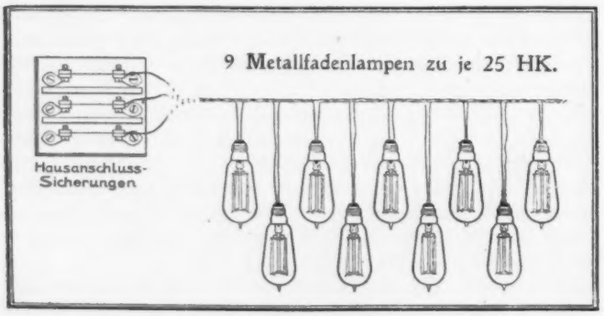


FIG. 3.—TUNGSTEN LAMPS.

32 hefner candles or nine tungsten lamps rated at 25 hefner candles may be used. Six 25 or nine 16 hefner candle-power tantalum lamps could also be substituted without additional expense for electricity. By the aid of some such pictorial illustration a solicitor could make even a deaf and dumb person comprehend.

INTERIOR WIRING AND ILLUMINATION

Wiring a Church Building at Low Cost.

By T. W. Poppe.

The efficient lighting of a church in a small town is always a good advertisement for the central station. To be effective the lamps must be of proper candle-power, properly placed, and the wiring must be done in a neat and substantial manner. All wires and wire-concealing devices, as molding and conduit, should be hidden from view. Should the members of the church see any fittings or appliances that would detract from the appearances of the edifice, they would be adverse to having their own residences equipped for electricity, fearing that the wiring would have to be done in a similar manner. Not knowing the difficulties experienced in wiring the church building

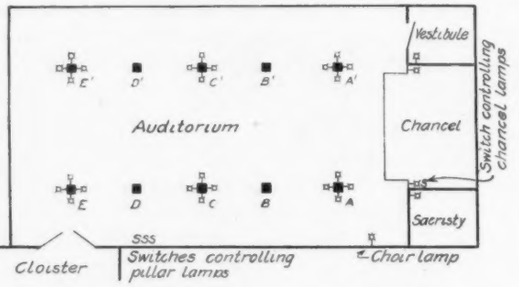


FIG. 1.—PLAN VIEW OF CHURCH BUILDING.

they would naturally take the work done there as a standard. If the job is not done neatly they would be unwilling receivers of any proposition to wire their own residences.

The church building, which was wired as explained later, was equipped at low cost by the central-station company and the general satisfaction with which the work was received resulted in the wiring of several residences, which meant more business to the central station. Fig. 1 is a floor plan of the auditorium, pulpit, chancel, sacristy and vestibule showing the entrance into the auditorium from the cloister. The pillars marked *A A'*, *C C'* and *E E'* were to be wired so as to admit of no shadow being cast by pillars *B B'* and *D D'*. It was decided to place a

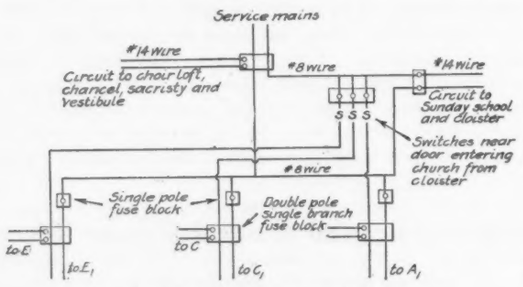


FIG. 2.—DIAGRAM OF WIRING CONNECTIONS.

bracket on each side of the pillars in such a way as to reduce whatever tendency pillars *B B'* and *D D'* might have to cast any shadows. As the church auditorium was dark, the woodwork having a black walnut finish, four 100-watt, 80-cp tungsten lamps were used to get sufficient light despite absorption. This meant 320 cp on each pillar wired. To harmonize with the woodwork and retain the severe simplicity of the auditorium, plain brackets of wrought-iron finish were procured. In the chancel one 80-cp tungsten lamp was placed on each side of the arch leading into the chancel from the pulpit. These lamps were placed as near as possible to the corner formed by the piers supporting the arch, and the partitions which divided the chancel from the vestibule and sacristy, because of a desire to

reflect the light upon the chancel; the decorative finish being white and the wall construction acting as a good reflector. In the vestibule and sacristy one lamp bracket was installed, as indicated in Fig. 1. These brackets had the same finish as the ones installed in the auditorium.

Fig. 2 shows a diagram of the wiring for the auditorium, chancel, vestibule and sacristy. This wiring was done in the cellar by means of knob-and-tube work. To wire the pillars, which were 12-in. x 12-in. beams covered by ⅞-in. finishing boards, it was necessary to remove one of the boards. This was done by driving the nails through the boards with a nail-set. A channel ⅝-in. deep and 1 in. wide was cut into the beam with a gouge. In this channel two No. 14 rubber-covered wires enclosed by flexible tubing were placed. As the rules of the underwriters require flexible tubing to be continuous from support to outlet, it was carried through the flooring to the porcelain support below and to the bracket outlet on the pillar. As it was necessary to have an outlet on each side of each pillar a 1¼-in. hole was bored into the beam through the face boards where the brackets were to be placed. These holes were made 2 in. deep. From the first outlet a 1-in. hole was bored toward one of the other holes on the side of the pillar. The 1¼-in.

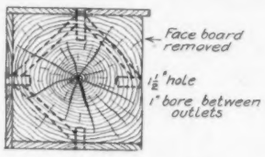


FIG. 3.—DETAIL OF PILLAR.

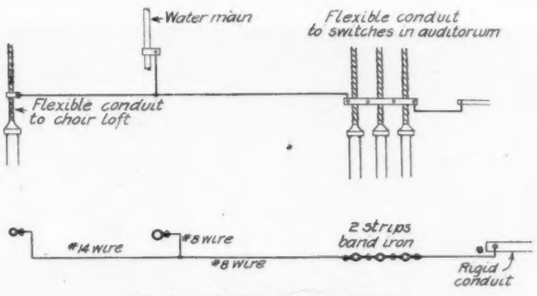


FIG. 4.—METHOD OF GROUNDING.

hole permitted this to be easily done, and in this way any danger of boring through the face boards by any miscalculation or misdirecting of the auger bit was avoided. The facing was unmarred, and a raceway for the flexible tubing containing the circuit wires was provided in this way. This method was used in every case. Fig. 3 is a diagram of a pillar thus bored.

At the choir loft a one-lamp bracket was placed high enough to reflect the light upon the books of the singers. As this bracket was fastened to a furred stone wall it was contrary to the rules of the underwriters to draw any flexible tubing be-

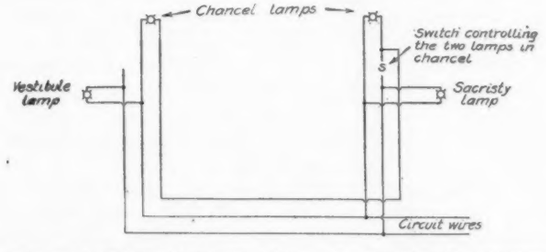


FIG. 5.—ARRANGEMENT OF LAMPS ON THREE-WIRE CIRCUIT.

tween the plaster and stone. The condensation would probably affect the tubing and insulation in such a manner as eventually to render it useless. To overcome this disadvantage, a flexible steel-armored conduit containing two No. 14 wires was run into an outlet box at the brackets and a wire-separating device or condulet was fitted on the other end of the conduit in the cellar. As no switch was provided for the control of the choir lamp, and as it was out of reach, a chain-pull socket was placed on the bracket. A chain with the same finish as the bracket was used and brought low enough for a person of average height to reach it. It was necessary to ground all the conduit in the building and Fig. 4 shows how this was done. As a 6-amp fuse protected the wire in the steel-armored conduit, a No. 14 wire was connected to the conduit, with a ground clamp made of band iron ⅛ in. thick and 1 in. wide. A piece of sheet lead was placed between the band iron and the conduit to insure a good electrical connection.

The wiring in the chancel was placed in molding inasmuch as it was not visible from the body of the church. This molding was made to carry three wires, so that a single-pole switch could be installed on the molding at the point shown in Fig. 1. This switch controlled both lamps in the chancel. From these moldings wires placed in flexible tubing were drawn through the plastered partitions to the bracket outlets in the vestibule and sacristy. As it was necessary to have the wires to the lamps in the vestibule and sacristy alive at all times and the wires between the lamps and switch in the chancel partly so, the reason for installing the three-wire molding is apparent.

The door leading into the auditorium from the cloister being used most, the switches controlling the lamps on the pillars were placed on the right-hand side of the door coming in. Each switch controlled one pair of pillars lettered the same. As the same conditions regarding condensation existed here as in the case of the choir bracket wiring the conductors were run in a similar manner, using a three-gang switch box and 10-amp.

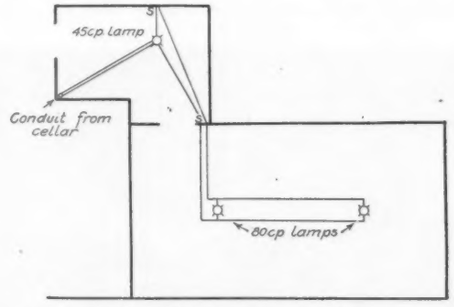


FIG. 6.—PLAN OF CLOISTER AND SCHOOL ROOM.

single-pole flush switches with wrought-iron switch plate. To make the switches less conspicuous the pearl disk generally placed on the button was removed and a disk of black composition substituted. The wires to the switches were connected to the mains as shown in Fig. 2, a three-wire, main-line, fuse-block with 10-amp fuses protecting the wire and switches. The wires from the switches were then run to the pillars; fuse blocks being placed at the first of each pair of pillars so that the circuit could be divided. Only 660 watts are allowed on a circuit and the lamps on each pair of pillars required 800 watts. By placing fuse blocks at the pillars 400 watts were run on a circuit and the No. 12 circuits made a subsidiary main. The conduit protecting the wires to and from the switches was connected to the ground wire. As this wire was apt at any time to be called upon to carry 30 amp to ground, a No. 8 grounding wire was used. As this wire was the largest ground wire in the building it was connected to the water main by means of a ground clamp, as shown in Fig. 4.

Through the wall separating the cloister from the church a ½-in. conduit was installed and carried up through the flooring of the cloister, as shown in Fig. 6, to a point 7 ft. above the floor, where a suitable wire-separating device was placed. From this point a three-wire molding was carried to a point near the door entering the Sunday-school room. From the molding point rigid conduit was run through the cloister wall, which was of wooden construction, and up the side of the Sunday-school building, which was a stone structure connected to the church building by the cloister. The wires were run to a point under the edge of the roof where the conduit was carried through the wooden framework supporting the roof to a point between the roof and ceiling of the Sunday-school room, where the wireman could work easily. Here a wire-separating device

was placed on the conduit and the knob-and-tube system of wiring resorted to. The conduit in the cloister was connected to a wire by drilling a ⅛-in. hole into the conduit. This hole was tapped for a screw. The wire was placed in position, using a washer to more thoroughly bind the wire, and the conductor was carried back to the other conduit, in the middle groove of the three-wire molding, where it was fastened in a similar manner. The conduit entering the cellar from the cloister was grounded in the same way to the No. 8 wire.

Sidewalk Illumination from Tungsten Lamps.

The illustration herewith shows a photographic reproduction of sidewalk illumination by tungsten lamps on the north side of Dexter Avenue, the main business block of Montgomery, Ala. The tungsten lamps burn from dusk to midnight and illuminate the sidewalk brilliantly. The Citizens' Light, Heat & Power Company of Montgomery, Ala., has recently taken hold of the tungsten-lamp proposition, and starting about Dec. 15 conducted a whirlwind campaign under the direction of Mr. E. C. Bacon, assisted by a corps of lighting experts, to introduce the lamp. As a result the company has succeeded in installing a great number of lamps in a remarkably short time. In addition to the introduction of tungsten lamps in various mercantile establishments, ranging from large department stores, clothing establishments, cafés and drug stores to sidewalk fruit stands, the company has made an exhibition of sidewalk illumination by means of tungsten units which is said to be second to none. All but four of the stores on the block shown are supplied with energy from the company's circuits. Five-lamp, 100-watt tungsten fixtures are installed in front of the stores of each customer, and all of the energy is sold on a meter basis.

TUNGSTEN LAMP SIDEWALK ILLUMINATION AT MONTGOMERY, ALA.

The policy of the company is to put out tungsten lamps on a meter basis in place of flat-rate carbon-filament lamps and arc lamps. At the beginning of this campaign with tungstem lamps practically all of what would otherwise have been the most profitable business was on a flat rate. This rate was very low owing to the competitive conditions existing in Montgomery. The flat-rate customers were shown that by using a high-grade lamp, such as the tungsten, with the service furnished by the company, it was to their advantage to use lamps on a meter basis. The result is that the company is now not only getting a better rate for the maximum demand of the lamps installed, but has also secured the elimination of much waste of energy by causing its customers to turn off the lamps when not needed, whereas the carbon-filament and arc lamps used on the flat-rate basis would be burned sometimes 24 hours a day, depending on the conscience of the customer. The net result of the new policy is that the company has changed from a flat-rate to a meter basis, reduced the demand by substituting 60-watt tungstens for 32-cp, 3½-watt carbon-filament lamps and thereby increased the capacity of its plant, lines and transformers. By giving its patrons more and a better quality of light for the same amount of money, the latter have become so enthused that sidewalk illumination is being indulged in by many whose bills are being increased rather than decreased by tungsten installations.

The Citizens' Light, Heat & Power Company began operations June 1, 1904, with Mr. Alexander Rice as president and Mr. P. R. Whiting as manager. The company has a modern compound, condensing steam plant located on the railroad and river which enables it to receive its coal cheaply and also an abundance of water for condensing purposes.

Letter to the Editors.

Central Station Accounting.

To the Editors of Electrical World:

Sirs:—One can easily imagine the dismay of the average central-station manager when faced with the problem of conforming in his accounting methods to the requirements of the New York or Wisconsin Public Service Commission. It remains a live question if the extremely elaborate systems devised by these bodies are actually necessary to enable them to carry on their work within the scope fixed by the law, for the corresponding Massachusetts Commission has apparently been able to discharge its duties satisfactorily without subjecting central stations under its jurisdiction to the preparation of reports in such extreme detail. However, thus far the interests affected have not been able to set up any effective resistance to the accounting requirements imposed; and it is not at all evident whether this is due to lack of leadership and co-operation, or because the commissions have been able to justify their demands.

But it does not follow that the cost of keeping up a system of accounting such as that imposed by the New York and Wisconsin commissions is at all in proportion to its apparent complexity. Practically every item called for should in the past have been a matter of some record in every well-conducted central station, and consequently the greatest hardship will fall on the stations which have heretofore deregarded systematic methods in their business conduct. Even assuming that there will be considerably increased cost in the book-keeping department of some stations, this may be easily compensated for if advantage is taken of the means which the various classifications will afford for the analysis of the cost of service. In the past central stations have relied entirely too much on their monopolistic feature and have ignored the methds of minute accounting of costs which in recent years have been adopted by manufacturers in branches where competition is keen. Since

such a system is now being forced on them, the brighter and more energetic central-station men will doubtless get in line with their fellows in other fields of manufacture, and know exactly the cost of delivery of every class of their product—namely, electrical service.

Another good effect of the accounting systems with respect to the central-station industry at large will be the weeding out of the managerial type always ready with objections against anything new or any change from the old, usually on the general grounds of "local conditions," "years of experience in the business," "no profit at less than 20 cents per kw-hour," etc. The publication of accounts in comparative form will enable directors and active stockholders to locate shortcomings by checking figures with those of plants similar to their own, or at least will suggest questions difficult to evade and the answers to which will furnish some indications of managerial calibre.

Upon the whole it would seem that the elaborate accounting systems being imposed on central stations by law are not an unmitigated evil.

MILWAUKEE, WIS. J. S. THORNTON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Flywheel Effect in Armatures.—H. LUCKIN.—A table for quickly determining the stored energy or accumulated work in armatures, flywheels and other revolving bodies. The table gives the stored energy due to 1 lb. being rotated at various r.p.m., the diameter of gyration being 1 in. To use the table, multiply the figure from table—to suit revolutions per minute—by weight in pounds and diameter of gyration in inches squared.

R.P.M.	+0	+10	+20	+30	+40	+50	+60	+70	+80	+90
100	.00296	.00358	.00426	.00500	.00579	.00665	.00757	.00854	.00958	.0107
200	.0118	.0130	.0143	.0156	.0170	.0185	.0200	.0216	.0232	.0249
300	.0266	.0284	.0303	.0322	.0342	.0362	.0383	.0405	.0427	.0450
400	.0473	.0497	.0521	.0546	.0572	.0598	.0625	.0653	.0681	.0710
500	.0739	.0769	.0799	.0830	.0861	.0893	.0926	.0960	.0994	.103
600	.106	.110	.114	.117	.121	.125	.129	.133	.137	.141
700	.145	.149	.153	.158	.162	.166	.171	.175	.180	.185
800	.189	.194	.199	.204	.209	.214	.219	.224	.229	.234
900	.239	.245	.250	.255	.261	.267	.272	.278	.284	.290

For example, the stored energy due to 530 lb. being rotated at 700 r.p.m. when 25 in. is the diameter of gyration $= 0.145 \times 530 \times 25^2 = 48{,}000$ ft.-lb. For armatures up to about 20 in. diameter, the diameter of gyration is usually from 0.65 to 0.70 times the armature diameter, while for armatures from 20 in. to 40 in. in diameter it will vary from 0.7 to 0.75, while in very large machines it may be as much as 0.85 times the armature diameter—this proportion depends largely on the number of poles. The table may also be used for revolutions per minute from 1000 to 9900 (advancing by hundreds) by moving the decimal point two places to the right—i.e., for 3000 r.p.m. read 2.66.—Lond. *Electrician*, Feb. 5.

Connecting Alternators in Parallel.—F. LUTZ.—An illustrated description of a device for automatically connecting two alternators in parallel. The speed regulation of the second machine, which is to be connected in parallel, is also completely automatic. *A* and *B* in Fig. 1 are two small transformers, each with three windings. The windings *a* and *b* are equal, the windings *c*, *d*, *e* and *f* are also equal. *C* is an alternating-current motor; between the poles of an electromagnet there is placed a permanent magnet of relatively small mass to the end of which two arms are attached which are able to arrest a gear wheel *h* as shown in the illustration. This wheel drives a gear wheel *i* which is suspended as a pendulum, but is removed from the wheel *h* whenever the electromagnet *l* is excited. When this action takes place the wheel *i* always assumes such a position that the heavy pin *k* is at the bottom. When the electromagnet *l* is not excited the wheel *i* is driven by the wheel *h* and the pin *k* is taken around until it presses against the lever *m* and connection in parallel takes place as follows: The first machine which has already been running may be connected to the winding *a* and the second machine which is to be joined in parallel is connected to winding *b*. If there is no phase difference the voltages of *e* and *f* are in the same direction and therefore are added together, while the voltages of *c* and *d* annihilate each other. If there is a phase difference the opposite is the case. Therefore, if there is no phase difference the motor *C* is supplied with current and the wheel *h* revolves. The electromagnet *l* is not excited and the wheel *i* is therefore driven by the wheel *h*. This condition will exist as long as there is no phase difference. Under these conditions the pin *k* gradually gets nearer and nearer the lever *m* until it reaches it and raises it. The contact *n* is thereby closed and the switch making the parallel connection is set in operation. If, however, just before this takes place a phase difference should occur again, the motor *C* loses its current and the electromagnet *l* is excited. The wheel *i* is thereby removed from the wheel *h* and the pin *k* drops to the bottom. Connection in parallel takes place, therefore, only when no phase difference has been maintained for a certain period and this period can be adjusted by adjusting the path which the pin *k* has to travel until it presses against the lever *m*. By adjusting the electromagnet *l* and the

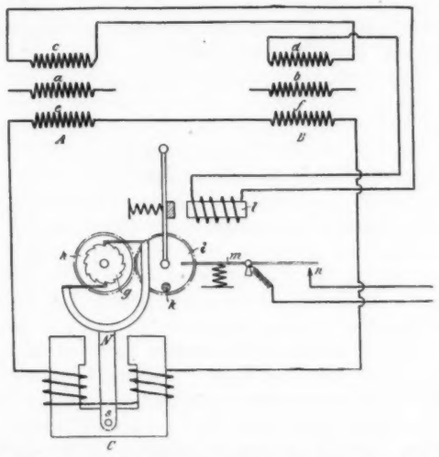


FIG. 1.—CONNECTING ALTERNATORS IN PARALLEL.

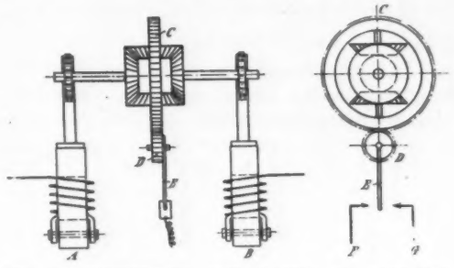


FIG. 2.—CONNECTING ALTERNATORS IN PARALLEL.

electromagnets of the motor *C*, the apparatus may be made independent of the voltage within wide limits. It is then influenced only according to whether there is phase difference or not. For the automatic regulation of the speed of the second machine to be connected in parallel the device of Fig. 2 is used. *A* and *B* are again two alternating-current motors acting upon gear wheels. These two wheels are connected together by the gear shown in the illustration. The arrangement is such that the two wheels have a rotation opposite to each other. If they revolve with equal speed the wheel *C* remains at rest, but if the wheels *A* and *B* revolve with different speeds the wheel *C* rotates in one or the other direction. The wheel *C* is geared to another wheel *D* to which is fixed the contact brush *E* which can make contact with either *F* or *G*. By means of these contacts there is regulated an electric motor which influences the regulator of the steam engine of the second machine. The speed of the steam engine is therefore increased or decreased—according to the rotation of wheel *C*—until complete equality of frequency of the two machines has been obtained. This condition exists when the contact brush *E* is not in contact with either *F* or *G*.—*Elek. Zeit.*, Feb. 11.

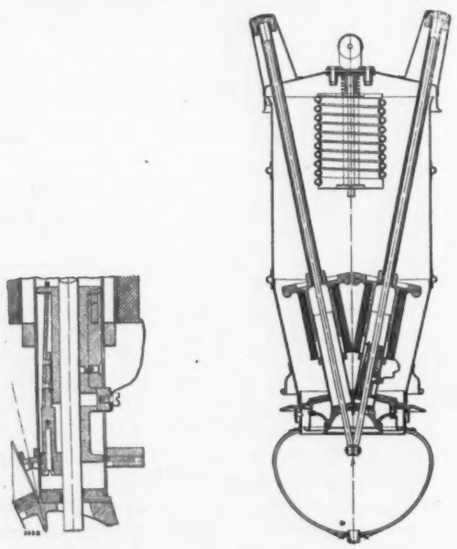
Testing Direct-Current Machines.—W. Lulofs.—An illustrated paper read before the Birmingham section of the (British) Inst. Elect. Eng. The author shows how the Kapp-Hopkinson test may be adapted for a single lap-wound, direct-current machine with four or more poles, provided it is not supplied with Mordey equalizing connections.—Lond. *Electrician*, Feb. 12.

Turbo-Alternator.—A. C. Kolben.—The first part of a detailed description with drawings of the construction of a 3200-kw, three-phase generator directly coupled to a steam turbine. The speed is 980 r.p.m. The frequency is 49 cycles per second. —*Elek. Zeit.*, Feb. 11.

Brush Holder.—An illustrated note on a new brush holder for carbon brushes made by a British company. The holder is of the box type; the spiral spring for putting the necessary pressure on the brush is arranged directly over the center of the brush, and is entirely enclosed, so that it cannot fall off or get damaged. The breakage of the spring and its subsequent entanglement in the commutator is a cause of trouble in other types of brush holder.—Lond. *Electrician*, Jan. 29.

Lamps and Lighting.

Flame Arc Lamp.—An illustrated description of the Victor flame arc lamp made by a British company. Each feed control is derived from a magnetic circuit, produced by means of a series coil wound on an iron casting. The magnetic system operates two clutches, which feed the carbons, these latter being protected throughout the greater part of their length by brass tubing. The advantage of this construction is the absence of all shunt-coils, dash-pots, etc. These clutches are illustrated in detail by Fig. 3. Round the lower part of each of the inclined tubes a strong magnetic circuit is formed by means of a specially shaped iron frame, core, and a coil; each series coil is placed within such a frame, and provides the magnetic field for operating the clutch which slides up and down inside the core. The body of each clutch consists of a solid brass casting which has a cylindrical hole bored through it to take one of the electrodes, and is slotted at the lower end to allow of the pivoting of a soft-iron armature with a grip, shown on the left on the carbon in Fig. 3. This armature, which is in form something like a cheese-scoop, envelopes the top part of the clutch body nearly half way round. At the top end of the clutch is a soft-iron core enveloping the brass body for half of its circumference, as shown on the right of Fig. 3. As the clutch is supported in the air-gap formed between the end of the series-magnet core and the magnet frame, a magnetic force is exerted on the clutch armature when the current is switched on. This pull causes the grip to hold the electrode firmly, while at the same time the whole clutch is drawn up, thereby seeking to take a balanced position in the air-gap, and by this means the arc is struck. The manner in which these clutches feed the arc is shown in Fig. 4. To start with, the electrodes rest on a steatite striking-bar, and immediately the switch is closed, the electrodes are raised by the clutches, and are held there until the arc burns the electrodes away to such an extent that it can be no longer maintained. As soon as this happens, the clutches release the electrodes, which drop onto the striking bar, and touching one another, instantly strike the arc again; this feeding takes place approximately every 40 minutes. The flaming shape of the arc is obtained by means of a magnetic blow-out coil not shown in the illustrations. The coil produces a flat flame of great brilliancy and steadiness. The course of the current is from the positive terminal to one series coil, and from that by means of a flexible cable to the contact-screw on the clutch (Fig. 3). It then passes across the arc, through the second series coil, and thence through the blow-out coil and the central resistor (Fig. 4) to the negative terminal. The mean hemispherical candle-power of the lamp is high, being approximately 2500 cp for a 6-amp lamp, because the "extremely high voltage" employed across the arc enables a higher candle-power at a lower amperage to be efficiently maintained. The "Victor" lamps can be operated three in series on 220 volts, and under such conditions consume approximately, 0.2 watt per candle-power. The electrodes used are 23½ in. long, and have an average life of from 18 to 20 hours.—Lond. *Eng'ing*, Jan. 29.



FIGS. 3 AND 4.—VICTOR FLAME ARC LAMP.

Enclosed Flame Arc Lamp.—In flame arc lamps of the enclosed type with impregnated carbons arranged vertically, the arc is sometimes liable to burn unsteadily, as the electrodes become covered with a deposit and the arc tends to creep along this deposit up the side of the carbon. When two or more lamps are operating in series the effect is more pronounced. According to a recent British patent of A. D. Jones, of the Jandus Arc Lamp & Electric Company—5829, 1908, Feb. 4, 1909—this trouble can be overcome by the use of a "blow" magnet of annular form placed above the arc. This may be of the shape of an inverted cone, the top electrode passing through the center; generally the magnetizing effect of the current passing through the electrode in the center is found to be sufficient so that no special winding is required. As the lower electrodes in such lamps are thick and short, there is no need to arrange for the magnet to descend as the electrode burns down. The stray field from the magnet prevents the arc from rising up the electrode.—Lond. *Elec. Eng'ing*, Feb. 11.

Magazine Lamp.—An illustrated description of the "Angold" magazine flame arc lamp made by the (British) General Electric Company. It has been on the market for a year, but the mechanism has been improved from time to time. This lamp operates for over 50 hours with the nine pairs of electrodes contained in the magazines. The changing of the electrodes is effected in a few seconds. A forced feed of the electrodes is provided, and by a mechanical device the movement of the cross-bar is reversed when one pair of electrodes is nearly con-

sumed, so that the bar works up to the top again to engage with a new pair of electrodes.—Lond. *Elec. Eng'ing,* Feb. 4.

Photographic Arc Lamps.—A description of two arc lamps for photographic purposes made by a British company. The first of these is designed for operating singly or on either continuous or alternating current and with e.m.fs. from 100 volts to 250 volts. As the longest possible steady arc is very essential in photographic work, a regulating resistor—or reactor with alternating current—is recommended for use with this lamp. The lamp is switched on with a comparatively large resistance in circuit, and this is gradually cut out until the maximum steady arc length is obtained. The current consumed is from 14 amp to 15 amp or 10 amp, according as the lamp is used on 100-volt or 200-volt circuits. The second lamp, which is intended for heavier work, is made for operating singly on e.m.fs. of from 100 volts to 500 volts when continuous current is used, or from 100 volts to 250 volts when the supply is alternating. The current varies from 10 amp to 20 amp, according to the voltage used. This lamp is regulated in the same way as the other type, but is more rapid in action and illuminates a larger area; the length of arc with 10 amp on 500-volt circuits is about 6 in. It is used for portraiture, cinematograph work, and for printing.—Lond. *Electrician,* Jan. 29.

Supports for Metallic Filaments.—An abstract of a British patent—11,460, 1908; Feb. 4, 1909—of the British Thomson-Houston Company and T. E. Robertson. Metal filaments, liable to contraction, and supported rigidly at one end of the pedestal and looped over hooks at the other end, are further supported by spiral metal springs fixed either to the middle of the pedestal or to the lamp bulb. As the filaments are drawn inward or outward at the center by these springs, they will merely straighten somewhat on contracting. The lateral movement of the springs permits of unequal contraction of the two halves of the sections. Furthermore, hammering of the filaments on their supports at the tops of the loops during transit is prevented by the intermediate springs.—Lond. *Elec. Eng'ing,* Feb. 11.

Generation, Transmission and Distribution.

British Power Company.—An illustrated article on the development of the Lancashire Electric Power Company. Energy is generated at 11,000 volts, three-phase, the frequency being 50. Both overhead transmission and underground cable transmission are used. The load curve is quite satisfactory. From 6:15 in the morning to 5:30 p. m. the load does not drop below three-quarters of full load except at breakfast and at midday. There is an increased load due to lighting in the early morning and evening, but except for these variations the load is almost constant during working hours. The ratio between the maximum load on the station and the number of kilowatts representing the total connections is also a good one, the former amounting to about 3000 kw and the latter about 4200 kw.—Lond. *Elec. Eng'ing,* Jan. 28.

Italian Power Plants.—S. Q. HAYES.—An illustrated description of special features of the plants of the Societa Lombarda. This company has various hydro-electric and steam generating and transforming stations in the northern part of Italy where it supplies a large amount of energy to factories.—*Electric Journal,* February.

Low-Head Hydro-Electric Developments.—S. RICE.—An illustrated description of a plant at Milford, Maine, where 12,000 hp will be developed under a head of 20 ft.; the source of energy is the Penobscot River. The generating plant contains 12 700-kw alternating-current generators, and one 300-kw exciter. The generators produce three-phase currents at 2200 volts and 25 cycles.—*Power,* Feb. 9.

Direct-Current Motors.—R. H. FENKHAUSEN.—An elementary illustrated article on the installation of direct-current motors, giving directions for wiring, installing switches and connections, starting up and shutting down the motors, and hints as to what is to be done when the bearings of a motor get too warm.—*Power,* Feb. 9.

Motor Control.—D. E. CARPENTER.—The first part of an illustrated article on the application of automatic and semi-automatic controllers to direct-current motors. In the present installment the author discusses elevator control and safety devices.—*Electric Journal,* February.

Traction.

Ignition on Motor Cars.—Magnetic ignition is gradually supplementing in France all other methods of igniting the charge in the gasoline engines of motor cars, the tendency being particularly marked in the direction of magnetos of the high-pressure type. Two principal forms of high-pressure magnetos are being employed. In one the current produced at low pressure in the armature is transformed by an external induction coil; in the other the armature of the magneto is provided with two windings, low and high pressure—that is to say, the transforming of the current is effected in the magneto itself,

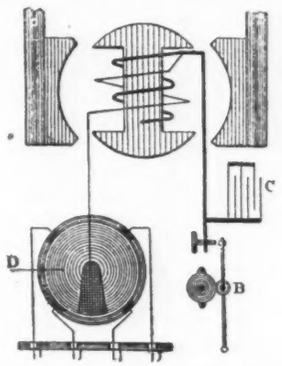


FIG. 5.—IGNITION ON MOTOR CARS.

as shown in Fig. 5. *B* is the contact breaker which opens the primary circuit; *C* is a condenser, and *D* a distributor sending current to the different cylinders of the engine. In view of the reduced space occupied and the greater simplicity of the connections, it is this type of machine to which preference is being given by motor-car manufacturers.—*Le Genie Civil;* abstracted in Lond. *Elec. Rev.,* Feb. 12.

Gasoline-Electric Railway Cars.—M. ROUSSO.—An illustrated description of the equipment of gasoline-electric motor-cars built by the French Westinghouse Company for operation on railways. They will be used, for instance, on a German railway line of secondary importance. Such roads on which the traffic is not strong enough to justify the erection of a power station and on which the operation with steam locomotives would not pay, gasoline-electric motor-cars may be used economically. One advantage is that the cars can be run at shorter intervals than steam trains so as to attract more passengers. These conditions are especially fulfilled on railway lines of secondary importance.—*Elek. Zeit.,* Feb. 11.

Mountain Railroad.—A note on the proposed electrification of the Ofoten mountain railroad in Sweden to the Norwegian frontier. It is used especially for ore transportation. It is 80 miles long and there will be 14 stations. Energy will be obtained from the waterfalls of the Tornetrask River.—*Elek. Zeit.,* Feb. 4.

Installations, Systems and Appliances.

Electric Station in Soudan.—An illustrated description of the electric equipment of the power station of Khartum, comprising two steam-driven, 200-kw, 3000-volt, three-phase alternators, condensing plant, boilers, pipework, and switchboards.—Lond. *Elec. Eng'ing,* Feb. 11.

Wires, Wiring and Conduits.

Self-Induction of Three-Phase Cables.—F. J. O. HOWE.—The author gives several formulas for calculating the self-induction of a three-phase cable, the last formula given by him is:

$$L_s = \left(c + 0.92\ log_{10}\frac{2a}{d}\right) 10^{-3}\ \text{henry per kilometer loop,}$$

the value of the constant c being taken as 0.1; a is the distance between the centers of two conductors and d is the diameter of the conductor. However, tests on various metals show that

this "constant" varies considerably. The author gives in a table the results of systematic self-inductance tests on three-phase cables. It is shown that the value of *c* varies in a fairly uniform manner inversely as the conductor cross-section and inversely as the insulation thickness. There are even negative values which are quite unexpected and apparently contradictory to the fundamental equation; however, they are by no means erratic.—Lond. *Electrician*, Feb. 12.

Electrophysics and Magnetism.

Variation of Conductivity of Air.—C. S. Wright.—An account of an experimental investigation the object of which was to observe the conductivity of the air confined in metallic vessels of lead, zinc, aluminum, possessing little if any radio-active impurity, and from the results to determine, if possible, what portion of the ionization was due to an intrinsic activity in the metal. The experiments were made at a number of points in the neighborhood of Toronto, both on land and over the water of Lake Ontario; and it was found that while a uniformly low and steady value was obtained for the conductivity over the water when more than a few meters in depth, values varying over a wide range were obtained for the ionization in measurements made on land at different places and on different soils. No evidence of a regular daily variation was noted. There is a penetrating secondary radiation set up by penetrating rays, such as those from radium, in the brick wall of a room. The water of Lake Ontario acts as a perfect screen both for the earth's radiation and, if a sufficient depth be taken, for the rays from radium. On this account and owing to the fact that the water of Lake Ontario contains no active impurity, it has been possible to determine what portion of the ionization in the receivers used in this investigation was due to residual active impurities and to intrinsic activity in the metals of the receivers. Based on this fact, a determination has been made of the ionization in free air due to radioactive impurities in a clay soil, and this value 9.9 ion per c.c. per sec. has been found to be in close agreement with a value deduced by Strong from Strutt's determination of the radium content of the earth. —*Phil. Mag.*, February.

Electrodynamics.—R. A. Lehfeldt.—The author criticises the method used in English books to treat magnetism before "current electricity," and to "explain" the latter by analogy with the action of magnetic shells. He suggests a new method of attacking electrodynamics for which he claims the advantage of deriving the two integral relations of electrodynamics from one, more easily comprehended, differential relation; moreover, it puts magnetism in its place as a special case of currents.—*Phil. Mag.*, February.

Inductance of Parallel Wires.—J. W. Nicholson.—A highly mathematical paper on calculating the inductance of two parallel wires. The author's solution includes all cases of practical importance, especially for very high frequencies.—*Phil. Mag.*, February.

Radiation Laws.—J. H. Jeans.—A highly mathematical paper on temperature radiation and the partition of energy in continuous media. The author atempts a critical examination of some of the difficulties which surround the application of the law of equipartition of energy to the energy of wave motion in the ether or other continuous media. These difficulties manifest themselves most clearly in connection with the problem of determining the law of partition of radiant energy inside a uniform-temperature enclosure. The theory of the author is especially interesting in its relation to Planck's radiation law. —*Phil. Mag.*, February.

Refraction.—T. H. Havelock.—An article on the relation between the dispersion of artificial double refraction and the ordinary dispersion of the isotropic medium, with special reference to the recent investigation by Hagenow of electric double refraction in carbon bisulphide.—*Phys. Rev.*, February.

Progress of Electric Science.—E. E. Fournier d'Albe.—A concise review of the progress of electrical science during 1908.—Lond. *Electrician*, Feb. 12.

Electrochemistry and Batteries.

Corrosion of Iron and Steel.—A. Sang.—A very long paper in which the author first discusses the composition and formation of rust and the various theories, especially the electrolytic theory, and then deals with the influence of structure and of stress on corrosion; with comparative corrosion of iron and steel; with corrosion in air, in fresh water, in salt water; with corrosion of ships, of rails, tubes, and wires. The author then takes up the influence of the impurities in the metal, discusses the comparative corrosion of acid and basic steel and deals finally with the corrosion of steel embedded in concrete and the attempts of inhibiting rust.—*Proc. Eng's Soc'y of Western Pa.*, January.

Electric Welding.—A continuation of the long and profusely illustrated serial on electric-welding appliances of British companies.—Lond. *Eng'ing*, Jan. 29.

Units, Measurements and Instruments.

Alternating-Current Measurements by Potentiometer Methods.—C. V. Drysdale.—An abstract of a paper read before the (London) Physical Society. The great difficulty in alternating-current measurements lies in the shortness of the range of the instruments available. The author suggested two methods of attempting to apply the potentiometer principle to alternating-current measurements: (*a*) the balancing of the alternating-current potential differences against a continuous potential difference, with the assistance of some suitable balancing device, or (*b*) the balancing of two alternating-current potential differences against each other. Potentiometers on the first principle seem unlikely to be successful owing to the insensitiveness of square-law instruments at low voltages; and the second method presents difficulties in that the two potential differences to be compared must be identical in magnitude, phase and frequency, and approximately so in wave-form. The author's recent experiments with a phase-shifting transformer have led him, however, to attempt to use it with a potentiometer, and the measurements are then made in the same manner as with an ordinary direct-current potentiometer, except that a vibration galvanometer or telephone is substituted for an ordinary galvanometer. By interposing an ammeter on the dynamometer principle in the main circuit of a potentiometer and deriving the current from the secondary of a phase-shifting transformer, it is possible to check the instrument with direct current against the standard cell in the ordinary way, and then to reproduce the same current in the potentiometer circuit and to bring it into coincidence of phase with the potential difference to be measured. The tests so far made seem to indicate that an alternating-current potential difference of 0.1 volt can be measured to an accuracy of 0.2 per cent or closer. The author has also designed a universal potentiometer on this principle, which serves both for direct-current and alternating-current measurements. Campbell remarked in the discussion that Drysdale's phase-turning method is interesting, but the vibration galvanometer is so very much more sensitive for its own frequency than for others, that it is not likely to give any indication of errors due to other harmonics unless they are very pronounced. Hence the method must be used with great caution. In reply, Drysdale said that for ordinary standardization of potential difference and current, this difficulty does not present itself, as there is no difficulty whatever in obtaining a sufficiently closely sinusoidal wave-form, and the wave-forms of the measured and balancing potential differences are usually similar, being derived from the same source. For inductance and capacity measurements there is, of course, a positive advantage in an instrument which disregards the harmonics.—Lond. *Elec. Eng'ing*, Feb. 11.

Deflection Potentiometer for Voltmeter Testing.—H. B. Brooks.—In a former paper the author derived an expression for the current through the galvanometer of an unbalanced potentiometer, used in connection with a volt box, and showed how this formula could be applied to the design of a class of instruments, for current and voltage measurements, having properties intermediate between those of the balance type and of the deflection type. A description was also given of an instrument constructed on this principle, which was used for measuring voltage in photometric work, and which has now been in service for the past two years, giving satisfactory speed and accuracy. The object of the present paper is to give some

further modifications of circuits which may be used for this purpose, with their advantages and defects; to show what features should be incorporated in an instrument of this kind for such work as the testing of voltmeters, and to describe an instrument of this type recently constructed. This has been designed for voltmeter testing and other precision measurements of voltage in the laboratory and testing room.—Lond. *Electrician*, Feb. 5.

Compound Voltmeter for Measuring the Voltage at the End of a Feeder.—L. PILLIER.—A description of a new method of Chauvin and Arnoux for measuring the voltage at the end of a feeder without the use of pilot wires, with the aid of a precision galvanometer, for instance, a moving-coil permanent-magnet instrument for direct current. The connections are shown in Fig. 6 where E is the voltage at the power station, R the

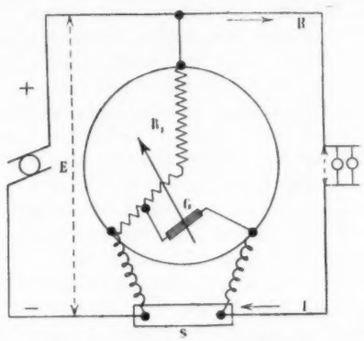


FIG. 6.—DIAGRAM OF CIRCUITS.

resistance of the transmission line to the point at the end of the feeder, where the voltage is to be measured, and I is the current in the feeder. G is the galvanometer and is connected, as shown in the illustration, in series with R_1 across the feeders, but also in parallel with the shunt S having resistance equal to G. It can then be shown that the current through the galvanometer is proportional to $E - kI$ where k depends only on the constants of the galvanometer and these may be so adjusted that k equals the resistance R of the transmission line. The current to the galvanometer is then proportional to $E - RI$ and therefore gives directly the voltage at the end of the feeder. Connections of such an instrument for a three-wire system are also shown.—*L'Industrie Elec.*, Feb. 10.

Flicker Photometer.—An abstract of a British patent—6971, 1908; Feb. 4, 1909—of W. Fennell and W. P. Perry. In the ordinary "flicker" photometer the eye sees alternately two surfaces illuminated respectively by the two sources of light to be compared, and the illuminations are equal when no flicker is observed. The general arrangement has the disadvantage that the light strikes and leaves the surfaces at an angle, and this angle must be the same for both surfaces or the reading will be inaccurate. This fact necessitates an expensive construction. The modified form described in the patent specification comprises a rotating disk consisting of two or more sectors of translucent material separated by radial opaque films. The disk is illuminated at the sides, and observed on edge. Opaque covers are fixed to one side of each sector so that each is illuminated from one side only.—Lond. *Elec. Eng'ing*, Feb. 11.

Telegraphy, Telephony and Signals.

Convention of Telegraph Engineers.—K. STRECKER.—An account of the international convention of telegraph engineers in Budapest in September, 1908. There were present 25 representatives of Hungary, 12 of Austria, 12 of Germany, 4 of Roumania, 3 of Great Britain, 3 of Italy, 3 of Servia, 2 of Netherlands, 2 of Sweden, 2 of Turkey and one each of Bulgaria, Denmark and Russia. Abstracts of the papers presented are given. The full papers are contained in a printed report of 400 pages.—*Elek. Zeit.*, Feb. 11.

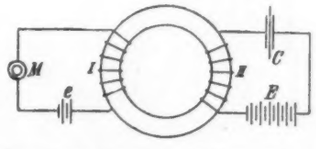
Underground Telephone Cables in Great Britain.—O'MEARA.—An abstract of a paper read at the recent international conference in Budapest. Longer underground telephone cable lines have been built in Great Britain since 1895. The chief lines are from London to Birmingham and Glasgow (420 miles), from London to Bristol and Tavistock (320 miles), from Liverpool to Manchester and Leeds (72 miles), besides some smaller lines and branches. The cables are placed in iron tubes of 7.5 cm inside diameter. Some information concerning the construction of the cables and the speed of transmission is given. The cost of maintenance in the past year was 10 cents per kilometer against 83 cents—without cost of renewal—per kilometer overhead line.—*Elek. Zeit.*, Feb. 11.

Determining the Properties of Telegraph or Telephone Lines.—GATI.—An abstract of a paper presented at the recent conference of telegraph engineers in Budapest. The author uses a compensation method with two equal barreters. The alternating current to be measured (from 10^{-6} amp to 10^{-3} amp) is supplied to one barreter, thereby changing its resistance and deflecting the galvanometer needle. It is thus possible to measure telephone currents and currents in the receiver for wireless telegraphy. It is also possible to use the same method to determine the properties of a line and the damping.—*Elek. Zeit.*, Feb. 1.

Telephony.—HILL.—An abstract of a paper presented at a recent conference of telegraph engineers in Budapest. The British Telegraph office compares its telephone lines by means of the speaking tests with a standard line. A cable with 0.9 mm copper conductor and paper insulation with a lead cover is the standard—$R = 54$, $C = 0.034$, $L = 0.0067$ per kilometer loop. For any line a coefficient is determined which states what length of this line is equivalent to 1 km of standard line. Experiments have shown that it is possible to transmit speech over a distance of 735 km of standard cable with a damping factor $e^{-4.7}$. With Pupin coils it is possible to transmit speech a distance 3.7 times the distance obtainable without such coils. In the discussion Krarup pointed out the necessity of reaching an international agreement on the definition of a standard cable.—*Elek. Zeit.*, Feb. 4.

Miscellaneous.

Speaking Electromagnets.—W. PEUKERT.—The air-gap N S of a permanent magnet of horseshoe form is filled with a piece of soft iron provided with a winding which is connected with a battery e and the microphone M, as shown in Fig. 7. Any words spoken into the microphone M are then reproduced by the magnet. There is a perfectly closed magnetic circuit and each particle of the magnet core participates in the vibrations, so that strong sounds are obtained on account of the large vibrating mass. Instead of using a closed iron, an electromagnet may be used and in this case a second exciting winding connected to a battery is, of course,



FIGS. 7 AND 8.—SPEAKING ELECTROMAGNETS.

required. Such electromagnets are very convenient and do not exhibit any higher harmonics, as is the case with vibrating diaphragms. The author has also made experiments with the speaking condenser of Argyropoulos. The arrangement is shown in Fig. 8. M is a microphone, e and E are batteries, and C is a condenser. In this case the condenser C reproduces the sounds spoken into the microphone M.—*Elek. Zeit.*, Jan. 21.

BOOK REVIEWS.

SOCIAL ENGINEERING. McGraw Publishing Company: New York, 1909. By Dr. William H. Tolman. Cloth. 384 pages, 61 illus. Price, $2 net.

This is one of the most interesting and original books of recent years. It is a record of various things done along the line of uplift by American industrialists, who employ 1,500,000 of people. Dr. Tolman, who is the director of the Museum of

Safety and Sanitation, was selected by the Carnegie Institution of Washington to make a series of studies in this direction, and this book is the first outcome of the work. So far as we are aware, the facts and data have never before been collected. While it was well known that a good deal of work of this helpful character was being done, and while the book does not make an attempt to cover every effort of the kind, but takes typical examples, the presentation is most impressive and effective. It is difficult to imagine anyone going through these pages without being stirred and stimulated to do what he can in turn to make the industrial world better socially than he found it. Mr. Carnegie himself has written the introduction to the book, breathing this sentiment, and making the point that it is by the efforts of individual firms that the right solution of these problems can be reached, instead of through socialism, which can only talk speculatively, while the individual works practically, curing the evils that socialists are quick and eager to point out. The various subjects taken up by Dr. Tolman are those of efficiency promotion; the social secretary; hygiene; safety and security; mutuality; thrift; profit sharing; housing; education; recreation; communal or social betterment; and finally the pertinent inquiry, "Does it pay?" Under these heads each chapter presents a mass of facts and details, instancing in each case the company or firm and the number of people employed. It is interesting to observe that in several instances the material has been drawn from electrical concerns, and we are glad to note in this connection the General Electric Company, the Westinghouse companies, the Simplex Electrical Company, New York Edison Company, Niagara Falls Power Company, Interborough Rapid Transit Company, the Edison laboratories and factories at Orange, Western Electric Company, and Weston Electrical Instrument Company. In many instances, moreover, reference is made to the adoption of electric lighting and electrical devices adding to the comfort and convenience of employees.

One of the most interesting chapters is that on profit sharing, which, we think, will attract special attention, particularly because some concerns appear to have had a rather discouraging experience, while others, like the United States Steel Corporation, have adopted it on a most extensive scale. Incidentally, the book is of great value as affording many shrewd and practical hints how to handle bodies of men as working organizations, quite aside from any efforts to improve their daily condition without lessening their independence or breaking down the democratic spirit. We should not be surprised to see this work adopted largely for text-book purposes in the schools and colleges where sociological studies are taken up.

One of the sections of the book also is that which is devoted to the Museum of Safety and Sanitation, and to the work which is being done along the same lines in this country as in the 10 similar expository institutions already established in Europe. It is not out of place to note here that copies of the book are being used in connection with securing memberships in the Museum of Safety and Sanitation, to which the author is now devoting his entire attention. It may also be added that the *Century Magazine* has bestowed on the book in its March issue the unique compliment of publishing an article about it, as an expositions of the best tendencies to be found in American industrialism.

Electrical Illuminating Engineering. By William Edward Barrows, Jr., B. S., E. E. New York: McGraw Publishing Company. 212 pages, illustrated. Price, $2.

The author of this book, who is assistant professor in electrical engineering at Armour Institute of Technology, Chicago, first compiled the information which it contains as a series of lecture notes for use in his classes, the material being obtained from various modern technical literature pertaining to illumination. Considerable ground is covered by the book, and hence many of the subjects are very briefly taken up. For the student of illuminating engineering, the treatment is to be considered as suggestive rather than as being thorough enough for mastery of the subject without further reference to the original sources of information. Considerable value would be added to the book were references to the various sources of information incorporated. The first chapter is on "Light and Color," and takes up the coefficient of reflection from different surfaces, and the characteristics of different lamps as to color and also the intensity of illumination necessary for various kinds of work. The second chapter considers units of illumination and photometry and is a concise statement of the units commonly used in referring to illumination and illuminants. In view of the confused state of nomenclature, this chapter is very timely at present.

Under the chapter heading, "Photometry and Photometers," a brief description is given of nearly all the photometers which have been much used for the testing of lamps and illumination. In a chapter on "Spherical Photometry and Integrating Photometers," the Rousseau diagram method of obtaining the mean spherical candle-power is described, and the Kennelly graphic method is taken up at considerable length. Under the head of "Standards of Illuminating Power," a chapter is given on the various lamps which have been used as standards, and their ratios are tabulated. Extended chapters are given to the characteristics of incandescent lamps, arc lamps, flaming-arc lamps and vapor lamps. Brief consideration is given to shades and reflectors. The last chapter is devoted to illumination calculations, which will appeal to those who do not view with favor the more mathematical methods which have prevailed in connection with illuminating engineering. In practice certain elements which cannot be figured in the accurate calculations modify their results in other than skilled hands to an extent which is causing the practical illuminating engineer to rely less on such calculations and more on data now available from practical installations. The value of the book is chiefly as a ready reference work for those with some technical education, and as a series of suggestions as to matters which may be followed up with greater thoroughness elsewhere. Some parts can be employed as a text-book to advantage, while other parts would have no place in a brief course in illuminating engineering, as they involve the student in an attempt to cover, with lack of thoroughness, too much ground. There is, however, so little information in book form on illuminating engineering that every addition of this kind is valuable and welcome.

Rubber Trade Directory. New York: India Rubber World. 261 pages.

This volume is the first issue of an annual under the auspices of the *India Rubber World*, designed to place the rubber trade in line with other industries represented by directories. The greater part of the contents consists of a list of firms engaged in the rubber trade, the arrangement being according to States and towns, with a classification by specialties for each locality. A list is also given of the officers of all trade organizations representing the rubber industry. An appendix registers the trademarks, trade names and brands in all lines of rubber manufacture, and also gives a digest of the laws of the States relating to foreign corporations.

Fowler's Electrical Engineer's Handbook. Edited by William H. Fowler. Manchester: Scientific Publishing Company. 670 pages. Price, 1s. 6d.

The current edition of this useful publication benefits from a rearrangement of its contents to facilitate reference. While the work is intended more particularly for practical workers rather than professional engineers, the information and data have evidently been compiled with much care and thus the book is also valuable within its scope to the latter class. A section of particular interest is that in which are reprinted the rules and regulations for wiring, equipment, etc., issued to various British bodies, such as the Institution of Electrical Engineers, Board of Trade, Home Office, Lloyd's Register, etc.

Heat Energy and Fuels. By Hanns von Jüptner. Translated by Oskar Nagel. New York: McGraw Publishing Company. 306 pages, 118 illustrations. Price, $3 net.

This book is a translation of one of four volumes by Professor

Jüptner treating chemical engineering both theoretically and practically. It covers pyrometry, combustion, analysis of fuels, and the manufacture of charcoal, coke and fuel gases.

After describing the various forms of energy, as mechanical, heat electromagnetic, chemical and radiant, the author discusses in detail the chemical technology of heat and fuels. However, the treatment is more largely of an engineering nature rather than chemical. Three of the chapters are devoted to pyrometry, four to combustion, ten to solid fuels and six to liquid and gaseous fuels. The book contains much data relating to the manufacture of artificial fuels. This material is presented in the form of tables and of illustrations of practical equipments. The book is intended for use in engineering schools, but much of the information is arranged so as to be of value to practising engineers.

ELECTRICITY AND MAGNETISM. By J. H. Jeans. New York: G. P. Putnam Sons. 536 pages, 137 illustrations. Price, $4.50.

The author, who is professor of applied mathematics at Princeton University, has given an excellent mathematical treatment of electromagnetic phenomena. After defining electrostatics, magnetostatics and electromagnetism, complete discussions are given of physical principles, the electrostatic field of force, conductors and condensers, dielectrics and inductive capacity, the state of the medium in the electrostatic field, general analytical theorems, steady currents in linear conductors and continuous media, permanent and induced magnetism, the magnetic field produced by electric currents, induction of currents in linear circuits and continuous media, dynamical theory of currents, displacement currents, and the electromagnetic theory of light.

The character of the discussion is such that the so-called "practical" man would be unable to follow the author through the numerous processes taken by his demonstrations, but the student of electricity who is familiar with the calculus can obtain much valuable information from the book. The treatment follows closely that of Maxwell, but an attempt has been made to render it more elementary. It is well suited for the student in mathematical physics, for the physicist of limited mathematical attainments, and for the mathematician who wishes to make himself familiar with electromagnetic phenomena.

TRANSMISSION CALCULATION. By L. W. Rosenthal, E.E. New York: McGraw Publishing Company. 91 pages. Price, $2 net.

This book, which deals with the practical calculation of transmission lines, treats of the electrical performance problems rather than the mechanical problems involved in construction. It covers direct-current distribution for lamps, stationary motors and railway circuits; alternating-current transmission by overhead wires and underground cables; interior wires for alternating-current distribution, and single-phase railway circuits.

The information contained in the book is presented in extremely compact form by means of numerous tables for ready reference, the only descriptive matter included being that necessary to explain the use of the tables. Thus the book may be considered to consist of tables giving data relating to transmission circuits, and examples for illustrating the use of the tables.

Attention is called to the errors involved in certain familiar methods for calculating alternating-current transmission lines, and more accurate methods are described. One of the most interesting methods dealt with shows how the size of wire to be used in alternating-current transmission circuits may be determined directly from the volts loss in the line. The merit in this method resides in its accuracy and simplicity. The arrangement of the tables and examples should render the book well adapted for the rapid solution of problems relating to the electrical characteristics of transmission circuits.

INDUCTION COILS. By H. Armagnat. Translated and edited by Otis Allen Kenyon. New York: McGraw Publishing Company. 216 pages, 111 illustrations. Price, $2 net.

Of the 11 chapters of this book, four deal with the theory of mechanical and electrolytic interrupters and of induction coils, two with the construction of induction coils and interrupters, one with the uses of the coils, while the remaining four have been devoted to history, bibliography, and special devices.

Much of the haziness concerning the performance of interrupters and induction coils should be dispelled by the thorough treatment of the phenomena given by Armagnat, while the practical calculation of induction coils should no longer remain in the empirical class to which it has been assigned for many years. The treatment is characterized by clearness and accuracy, many of the conclusions being convincingly verified by means of oscillograms. A valuable feature of the book is the specific information concerning the constructive details of induction coils and interrupters. The student of induction-coil phenomena will be particularly pleased with the bibliography containing a list of a majority of the articles on this subject that have appeared in French, German and English, to which 25 pages are devoted.

The demand for a treatment such as that given by Armagnat has been created by the recent numerous applications of induction coils in medicine, radiography, wireless telegraphy and gas-engine ignition, and it would seem that this book should prove welcome at the present time.

LOGARITHMS AND SQUARES. By Constantine Smoley, C.E. New York: The Engineering News Publishing Company. Fifth edition, revised. 459 pages. Price, flexible morocco, $3.50 net.

The major portion of this hand-book is devoted to parallel tables of logarithms and squares of feet, inches and fractions of inches, varying by 1/32 in. from zero to 50 ft. and by 1/16 in. from 50 ft. to 100 ft. The logarithms are expressed in five significant figures. Tables are also given of angles and logarithmic functions. A five-place table of common logarithms of numbers from 1 to 10,000 is included, together with natural trigonometric functions and logarithms of these values. The book has been arranged particularly for structural engineers. That it has proved successful for this purpose is shown by the fact that the present is the fifth edition of the book.

ELECTRICAL ENGINEERING. By Charles Proteus Steinmetz, Ph.D. Schenectady, N. Y.: Robson & Adee. 284 pages, 48 illustrations. Price, $2.

This book contains a collection of lectures by Dr. Steinmetz on electrical engineering subjects arranged and edited by Mr. J. L. R. Hayden. Among the subjects treated are the distribution of energy for lamps and motors, the cost of energy as affected by the load factor, long-distance transmission of energy, high-frequency phenomena, generator and synchronous motor characteristics, lightning protection, direct-current and alternating-current railway motors, electrochemistry, incandescent and arc lighting, while light, illumination, lighting and lightning protection are discussed in appendices.

Mathematical equations have been almost completely eliminated, the presentation being made in the simple and instructive manner for which the author is so well known. The best portion of the book is that dealing with lightning and lightning protection, which, in fact, is the clearest explanation of this most difficult subject that has ever come to the attention of the reviewer.

The lectures were intended initially for engineering students, for which they are admirably suited. They should prove of equal benefit to practising engineers, and practical men in general, who wish to acquire information concerning the generation, control, transmission, distribution and utilization of electrical energy.

NEW APPARATUS AND APPLIANCES

Flaming-Arc Lamp with Gravity Feed.

There has recently been placed on the American market a type of flaming-arc lamp in which the inclined electrodes are fed downward solely by the action of gravity. One of the electrodes rests upon a fixed support on the body of the lamp, and the rate of feeding is determined by the rapidity with which the electrodes are consumed. In this respect the action is similar to that found in the Beck flaming-arc lamp. However, the arrangement employed differs in certain details.

One of the electrodes is provided with a longitudinal air-space placed eccentrically so as to be near the circumference at one point. During operation the thin wall of the electrode rests upon a refractory knife edge. As the electrode is consumed, the thin wall disintegrates and the knife edge allows this electrode to feed downward at the proper rate.

The two electrodes are interconnected mechanically by means of an insulated chain-mechanism which causes them to be lowered at the same rate, the composition of the two being such that the linear consumptions are equal. It is claimed that the arrangement employed is effective in preventing sudden movements of the electrodes and thereby eliminating flickering or unsteadiness of the light. The lamp is provided with the usual electromagnetic device for separating the electrodes in order to maintain the current at the proper value.

Tests made upon the lamp have shown that when using direct current of 8.27 amp and consuming 39.7 volts, the mean hemispherical light intensity was 1124 hefner-candles. Thus the watt per hefner candle in the lower hemisphere is 0.292. The above values refer to the lamp without globes. When globes are used the distribution is changed somewhat and there is a certain amount of absorption, but the value of mean lower hemispherical candles per watt is practically unaltered.

The lamp described above is the invention of Mr. Oskar Koenitzer, of Munich. The American rights for the lamp are held by Mr. Frank Z. Maguire, 10 Wall Street, New York City.

Chandelier for Nernst Lamps.

Since the new Westinghouse-Nernst chandeliers were put on the market several attractive variations of the original designs

CHANDELIER FOR NERNST LAMPS.

have been added to the list; one of the most pleasing is a square "art nouveau" cast chandelier, shown in the accompanying illustration. It is slightly more massive than the other designs and its ornamental treatment is somewhat more pronounced, without, however, sacrificing the simplicity characteristic of all these chandeliers. This design is made with either two or four arms and equipped with 66-, 88-, 110- or 132-watt lamps, either 110 volts or 220 volts, as desired. The four-arm 132-watt chandelier has an illuminating value equivalent to 28 16-cp carbon-filament lamps.

Mercury Type Amp-Hour Meters.

The principle underlying the action of the meter illustrated herewith is that of an ordinary electric motor, the permanent magnet providing the magnetic field in which the copper cup acts as the conductor or armature, commutation being effected

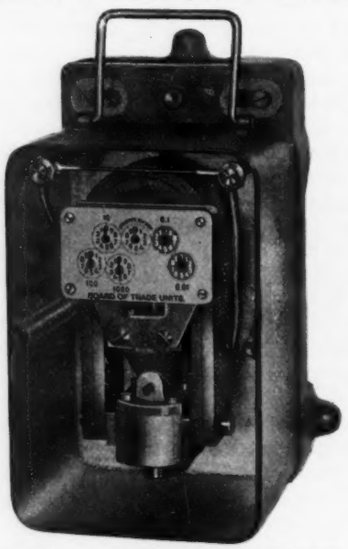


FIG. 1.—INTERIOR OF MERCURY-TYPE AMP-HOUR METER.

by mercury in which the cup is immersed. The current is led into the mercury bath at the top and out at the bottom, on the extreme edge of the cup, passing through the strongest and most condensed part of the magnetic field produced by the permanent magnet. It is stated that the error caused by the friction of the mercury has been practically eliminated by working with very high torque and strong braking forces. The mechanical friction is very small, owing to the extremely light pressure on the jeweled bearing. This result is obtained by counterbalancing the weight of the moving element by the thrust of the mercury, thus ensuring long life for the pivot and

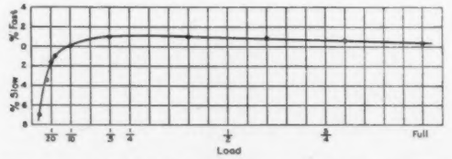


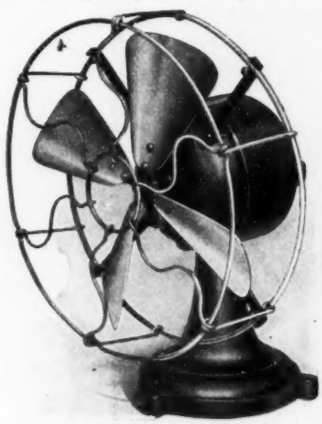
FIG. 2.—CALIBRATION CURVE OF AMP-HOUR METER.

jewel. The total losses in the meter have thus been reduced to an extremely low figure.

The characteristic error curve, shown in Fig. 2, closely approximates a straight line from the lowest load to full load, the meter starting easily with a load equal to ½ per cent of its rated full load. Friction having been reduced to a minimum, compounding is unnecessary. The meter described above is of the amp-hour type, but it is calibrated to read in kw-hours at any specified e.m.f. up to and including 600 volts. It has been placed on the market by the British Thomson-Houston Company, Rugby, England.

Dayton Fan Motors.

The line of fan motors built by the Dayton Fan & Motor Company, of Dayton, Ohio, includes 110-volt, 170-volt, 220-volt, 250-volt and 500-volt ceiling fans, electrolier fans, column fans, universal, oscillating and break-joint desk fans for direct-current circuits; alternating-current oscillating, universal and desk fans for standard frequencies, and with a 60-cycle ceiling fan. A Gramme ring armature is employed in the direct-current ceiling fan with a single bearing working continuously in oil. The brushes can be removed without taking any of the motor apart and the resistance for speed control is placed in a ventilated cover at the bottom of the fan where its heat is remote from the motor. In the oscillating fan a moving vane is employed outside the guard with stops for reversing the angle of the vane and hence the direction of fan swing. The alternating-current fans have blades whose curvature is such that an even breeze is obtained across the face of the fan, the air being projected as a solid cylinder instead of as a hollow cone. All styles of desk fans are readily convertible into the bracket type by use of a simple adapter. The low-frequency motors have two speeds, the low speed being obtained by cutting resistance



DAYTON FAN MOTOR.

MECHANICAL APPLIANCE VENTILATING FAN.

in series with the motor. Although the speed is somewhat lower than that of the 60-cycle motors, the pitch of the blades is increased. The 40-50-cycle fans have but one speed, while the 60-cycle and 133-cycle fans have two speeds. The 16-in., 133-cycle fan has but one bearing. This is of ample dimensions and is automatically and thoroughly lubricated. The shaft carries at one end the rotating secondary and at the other end the fan, the two parts balancing each other.

Mechanical Appliance Company's Fans.

A complete line of direct-connected ventilating fans for direct-current service in sizes from 18 in. to 42 in. is offered by the Mechanical Appliance Company, of Milwaukee, Wis., this season. These fans have the motor mounted direct on supporting arms attached to the wall ring; the fan itself being fastened to the motor shaft. Either open or enclosed motors are furnished with standard starters or with speed regulators. The fan blades are of the straight, Triumph, Blackman or Davidson type. In addition to the direct-current equipments the company is prepared to furnish ventilating fan outfits with single-phase motors in the 18-in. and 24-in. sizes and with polyphase motors in the 18-in., 24-in., 30-in. and 36-in. sizes. The alternating-current fans are not supplied with speed regulators, but can be furnished with either open or enclosed motors.

Dover Electric Fans.

The Dover Electric Manufacturing Company, of Canal Dover, Ohio, manufactures desk fans of the swivel and trunnion type. By simply loosening a thumb-screw in the base and a T-handle the fan can be changed from one form into the other. The field coils, magnet frame, armature core and windings, as well as other electrical features, have been designed and constructed with special reference to durability and high efficiency. The body and base are of black japan finish; the guard and blades are of brass and the bearings are babbitt lined, with large oil cups. Simple cartridge brush holders are employed and a three-speed switch. The 12-in. fans for 110-volt and 220-volt circuits and the 16-in. fans have a speed of 1550 r.p.m.

American Blower Company Equipments.

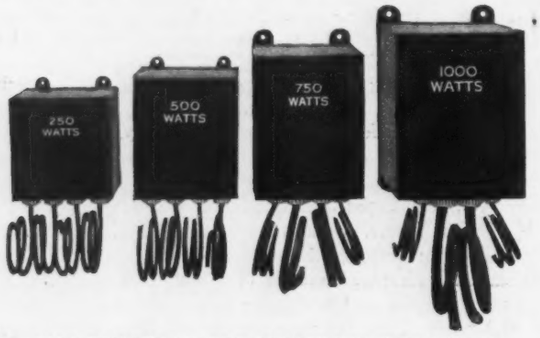
As suggestive of the possible field for motor-driven ventilating fans it may be pointed out that in factories, stores and public buildings some effective system of ventilation must be used to get rid of vitiated air and cause fresh air to enter. These results cannot ordinarily be obtained by a desk, wall or ceiling fan. The placing of an electric propeller or disk ventilating fan in an outside wall or window frequently solves the problem of ventilation in the kitchen of a hotel, restaurant or apartment house. For large kitchens, a more complete system with hoods and duct leading to the exhaust ventilating fan as illustrated in Fig. 1 is generally advisable. There is probably no line of business where the disk ventilating fan is more largely used and appreciated than in a laundry. Fig. 2 illustrates a scheme for the successful ventilation of billiard and pool rooms. A plan view is shown in Fig. 3 where *A* is an "American-Sirocco" fan, *B* a galvanized iron ventilating duct, *C* ventilating screens and *D* a section through the wall on *EE*. The "American-Sirocco" propeller fans are built regularly for belt or rope drive and for direct connection to motors and steam turbines. The principal advantages claimed are, large delivery of air against resistances of from 1 in. to 2 in. water-gage pressure at very low consumption of energy. When operating freely without resistances on suction or discharge sides, the capacity in cubic feet per horse-power is very great. These results are due to the curve or dip of the blades or vanes, of which there are 10 instead of 6, as usually obtain.

FIGS. 1, 2 AND 3.—AMERICAN BLOWER COMPANY EQUIPMENTS.

The fans are built by the American Blower Company, of New York, a consolidation of the American Blower Company and the Sirocco Engineering Company, of New York.

Transformers for Tungsten Lamps.

The Thordarson Electric Manufacturing Company, of Chicago, has designed and has ready for the market a line of transformers for low-voltage tungsten lamps, ranging in capacity from 150 watts to 1000 watts, with a standard secondary output of 10 volts. These transformers are so designed as to

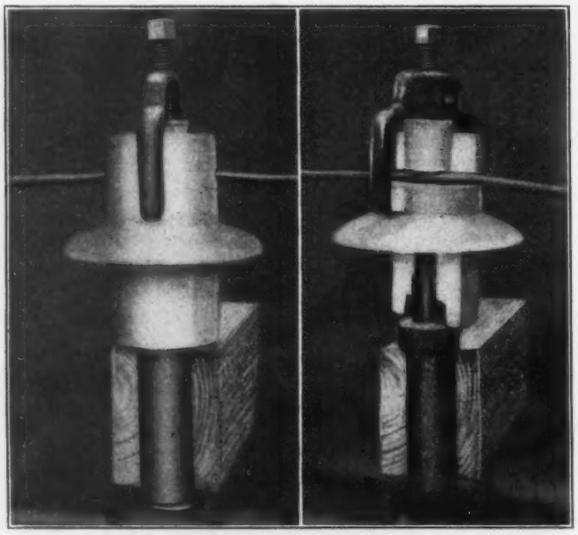


TRANSFORMERS FOR LOW-VOLTAGE TUNGSTEN LAMPS.

enable the use of a very short and compact magnetic and electric circuit, thereby reducing the weight to a minimum. For this reason they are especially adapted for sign lighting. While present demand is for sign lighting, the manufacturers believe that the saving by the use of the transformers in the case of residences will cause them to be introduced for this service, especially when 20-volt, 16-cp, 20-watt lamps are put on the market, which is but a question of a few months.

Insulator of New Design.

Mr. John L. Fay, of the Union Electric & Power Company of St. Louis, has designed and patented an insulator in which attention has been specially paid to the avoidance of mechanical injury where the wire is clamped to the insulator. A great deal of thought, experiment and money has been expended in the careful design and arrangement of the petticoats, or skirts, of insulators, so as to reduce as much as possible the danger of disruptive discharges from water dripping off the various



FIGS. 1 AND 2.—INSULATOR OF NEW DESIGN.

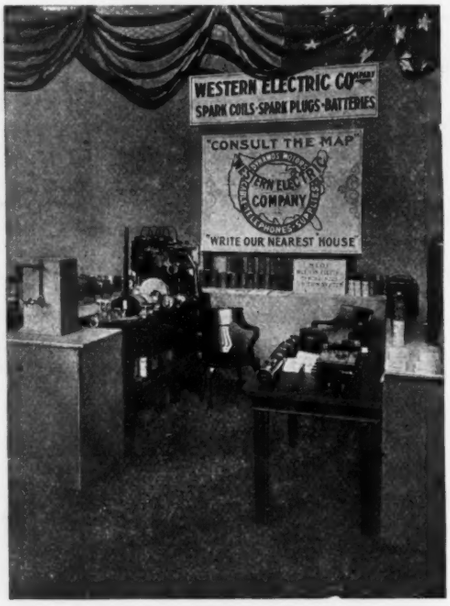
parts, and to keep dry as much as possible the under surfaces of the petticoats. Nearly all insulators having a metal clamp, set-screw or tie wire, which comes in direct contact with the wire which is supported, result in corroding, kinking or "cinching" the line wire, and if insulation is used upon the wire this results in wear and breakage of the insulation. This weakens the wire where it is attached to the insulator. In the insulator designed by Mr. Fay, which is shown in Figs. 1 and 2, there is nothing but porcelain in contact with the line wire. There is no metallic connection between the wire and the metal clamp, and no loose end of a tie wire which may reduce the insulating effect of the petticoat.

Gas-Engine Ignition System.

A new development in gas-engine ignition systems was displayed at the recent Motor Boat Show, at Madison Square Garden, New York City, by the Western Electric Company, whose exhibit is shown in the accompanying illustration.

This apparatus, known as the synchronous ignition system, embodies several new features, and was run in connection with a "Speedaway" engine, manufactured by the Gas Engine & Power Company, Morris Heights, N. Y. This system may be applied both to motor boats and automobiles.

With this device only one vibrator is used in connection with any number of non-vibrating coils. Two vibrators are pro-



GAS-ENGINE IGNITION SYSTEM.

vided, however, one being adjusted to give a heavy spark for starting with a cold engine; the other is for use when the engine is warmed up and running. This greatly reduces the battery consumption, making the system economical.

The change from one vibrator to another can be made by shifting a small switch which protrudes from the vibrator box. A pole-changing switch is also provided which is so arranged that every time the batteries are switched off and on again the direction of the current through the contact points is reversed. This feature eliminates the pitting which occurs at the platinum points in the ordinary vibrator. The non-vibrating coils are in a cylindrical, heat-resisting, insulated tube, which is mounted directly over the engine cylinders. This does away with the long high-tension leads so common in ignition systems, the high-tension leads in this case being only about 6 in. long. Any danger of leakage from the high-tension leads to the engine frame is also eliminated. The vibrators used are of special design, which insures smooth and rapid vibration; in fact, this vibrator makes 965 vibrations per second, making it the most rapid on the market. The entire system is provided with a lock switch, the key of which can only be removed when the battery is off. This system can be used successfully with any engine of three, four, six or more cylinders.

The Western Electric Company also showed a full line of

spark coils of both the motor-boat and automobile types, electric batteries and fire extinguishers. Both Marten and "Accurate" fire extinguishers were shown, and the batteries included the "Special 1900 Rapid Fire," the "Acme" and Hawthorne dry batteries, and "Vivax" storage batteries.

High-Tension Drop-Out Span Protectors.

Where high-tension lines cross telephone or other circuits it is essential that some method be provided for protecting the lower circuits from being subjected to dangerously high potentials in case the transmission line wires should break. Various methods of securing the desired results have been suggested. Some engineers require that where cross-overs occur, extra

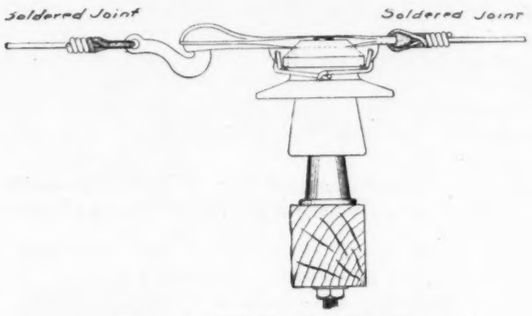


FIG. 1.—SINGLE-BREAK PROTECTOR.

high poles be placed close together so that if a break occurs the broken wires will not be long enough to reach down and make contact with the lower wires. In other cases the use of a grounded wire network or basket between the high-voltage and low-voltage wires has been required, but this has not always proved entirely satisfactory. Again, there are many cases where it is not feasible to set two high poles close together and the specifications for the grounded network often

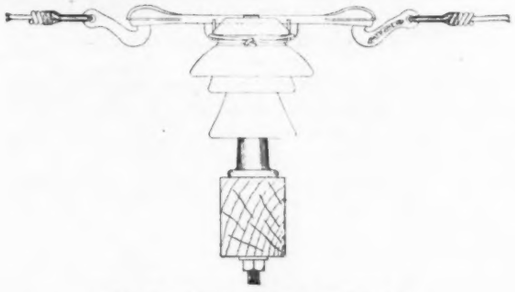


FIG. 2.—DOUBLE-BREAK PROTECTOR.

make it a very heavy and impracticable device, especially in cases where heavy wires are used on the transmission lines.

To meet the conditions actually found in commercial practice the high-tension drop-out span protector illustrated herewith has been devised. The device consists of two parts: a fixed element secured to either the top or side of a standard insulator, and a movable element connected to the transmission line and so arranged that by means of a ground ball joint it makes positive contact with the fixed element. It will be seen that

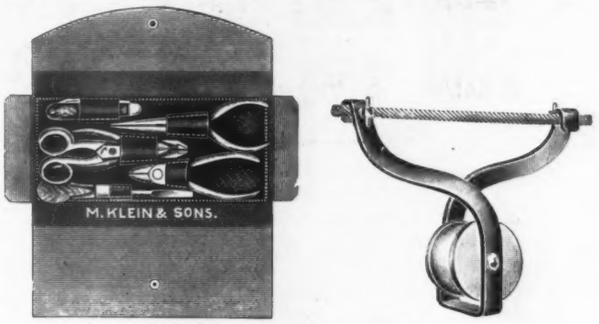
FIG. 3.—GROUND BALL JOINT.

with a span wire intact, heavy contact is maintained between the two elements of the connector, but upon the breaking of the span wire the movable element immediately drops and effectually disconnects, at the same time removing any danger of a live wire dropping down across the telephone or other wires which might be in position under the transmission wires.

The device is made in two types, No. 1 being a single-break protector and No. 2 a double-break, the use of which is obvious. These protectors are being placed on the market by the Central Electric Company, Chicago.

Tools for Line Construction Work.

Mathias Klein & Sons, of Chicago, Ill., have added to their stock of linemen's supplies and line construction tools and materials a number of new appliances, including a "Quick Samson" cable grip, a cable saw, cable roller and a pocket tool-kit for electricians. The cable grip was devised to expedite the handling of strand and messenger wire without injury to the wire. It is composed of two wedge-shaped, concave, notched



FIGS. 1 AND 2.—POCKET TOOL-KIT AND CABLE ROLLER.

jaws set in a metal casting and is so constructed that the jaws grip evenly when engaged with a cable or cable wire. At one end of the main casting are located two oblong rings to which the block and tackle may be attached. These rings are so arranged that by their use a straight pull on the wire is secured. The jaws of the grip are self-adjusting and are calculated to carry any strain necessary to tighten trolley or messenger wires.

The cableman's saw was designed particularly for use on cable work. It consists of a 14-in. silver-steel blade, one side of which is provided with coarse teeth for cutting through the lead sheath and the other side with finer teeth intended for use in cutting through the wire core of the cable. The blade is mounted in a substantial wood handle. The over-all length of the saw, which is shown herewith, is 18 in.

The cable roller is a device made to facilitate the stringing of

FIG. 3.—CABLEMAN'S SAW.

aerial cable. It consists of a forged-steel hanger in which is hung a maple roller. The two ends of the hanger, which are spread far enough apart to prevent rocking, are designed to hook over the messenger wire where they can be clamped to the wire by the aid of thumb-screws. The roller is provided with metal bushings to prevent it from wearing when carrying a load and to keep it in the center of the yoke of the hanger. By the aid of these rollers long stretches of cable can be strung with ease. The rollers weigh 4½ lb. each.

FIG. 4.—QUICK GRIP.

The pocket tool-kit, which is especially devised for the use of electricians, contains a single-bladed knife, 5-in. side-cutting pliers, 5-in. oblique-cutting pliers, 6-in. long-nose side-cutting pliers, 3½-in. blade screwdriver and 5-in. scissors. These tools, all of which are of Klein manufacture, are enclosed in a substantial pocketbook case 4 in. x 9 in. in size.

Jandus Electric Fans.

The following types of direct-current motors are being manufactured by the Jandus Electric Company, of Cleveland, Ohio, for the coming season: Swivel and trunnion desk and bracket fans in 12-in. and 16-in. sizes; oscillating desk and bracket fans in 12-in. and 16-in. sizes and 8-in. desk, bracket and telephone-booth fans. A line of fans, the same in size as the above, but equipped with induction motors, is also built in addition to

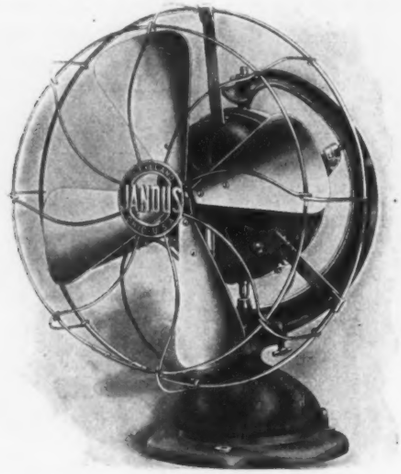


FIG. 1.—JANDUS SWIVEL AND TRUNNION DESK FAN.

direct-current and alternating-current 12-in. and 15-in. ceiling and column fans generally known as "Gyrofans." In the desk and bracket fans of the swivel and trunnion type, the swivel yoke is made by forming two ¼-in. steel rods into a strong and rigid support for the motor body, thus eliminating breakage and retaining at all times a pressure against the motor body, besides doing away with wing nuts and set screws. The oscillating type of motor has a positive drive, in that it neither employs the vane principle nor is it actuated by a train of gears, but depends upon the simplest form of differential gear

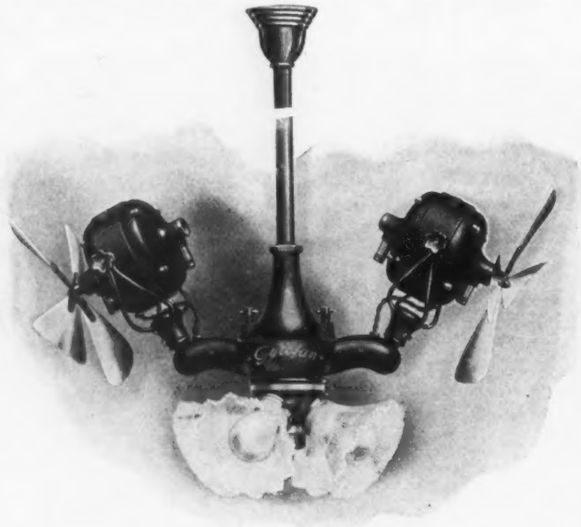
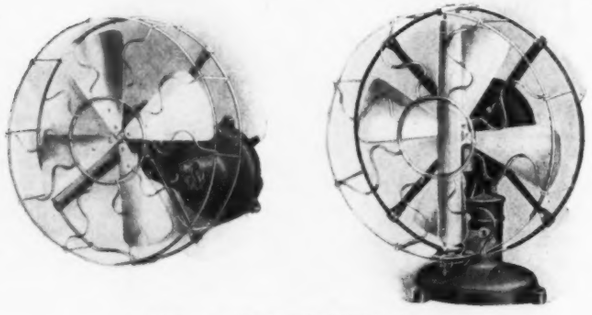


FIG. 2.—JANDUS "GYROFAN."

for its angular displacement. The "Gyrofan" consists of two fan motors pivotally mounted on a frame arranged to revolve about a vertical axis on a ball bearing. No energy is utilized for the revolution of the fixture, which results from the angular displacement of the motor shafts with respect to the vertical axis, or in other words, upon the angle at which the two fan blades impinge upon the air. The quietly revolving fixture carries the rapidly rotating fans around at the rate of about 10 r.p.m., thus throwing a strong whirling blast over a wide area and repeating it at any given point two times a minute. The fan for alternating-current circuits is manufactured for 110 volts and 220 volts, and for frequencies of 25, 40, 60 and 133 cycles. Self-starting, single-phase motors are used. The direct-current "Gyrofans" are built in the same sizes and voltages.

Colonial Fan Motors.

The entire line of the fan motors built by the Colonial Fan & Motor Company, Warren, Ohio, has been overhauled and improved in a number of ways during the past year. The line includes the well-known types built by the company last year to which has been added a universal desk and bracket fan, from which can be instantly obtained either the swivel or trunnion movement, when the fan is in the desk or bracket position. All types of fans have large, square brushes which cannot revolve and which retain their position on the commutator, thus doing away with noise and sparking. In order to obtain an increased brush surface, the commutators have been somewhat lengthened. The desk and oscillating fans are equipped with brass oil cups and brass switch levers, the latter fitted with molded rubber handles so as to preclude the danger of shock. The oscillating fan shown by Fig. 2 embodies distinctive features of construc-



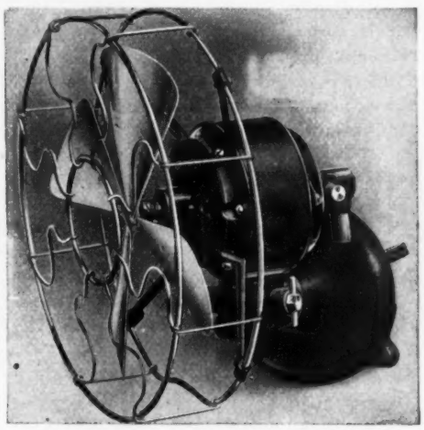
FIGS. 1 AND 2.—COLONIAL FANS.

tion. The field or rotating part travels on an entirely new type of tempered ball bearing accurately ground and polished so as to reduce friction to a minimum. A blade or vane, located just inside the guard where it is out of chance reach, operates the mechanism, being itself impelled by the air from the fan blades. Collector rings and brushes placed above a two-speed switch in the base of the fan make it possible to discard the flexible lead connections. The desk and bracket fans are built in 12-in. and 16-in. sizes and are intended for operation on 110-volt and 220-volt circuits. The three types of ceiling fans listed by the company are built for a uniform speed of 220 r.p.m. and for voltages of 110, 170, 220, 250 and 500. A rather complete line of ventilating fans forms part of the company's output.

Peerless Electric Fans.

The fan motors of the Peerless Electric Company, of Warren, Ohio, have been improved in details this season. Some of the new features relate to advance commutator construction and the employment of rectangular carbon brushes. A universal desk and bracket fan which is instantly convertible from one position to the other without the aid of tools while the fan is in operation, will be pushed this year, together with the popular oscillating fan. The universal fan closely follows the model of the swivel and trunnion type and is equipped with self-aligning phosphor bronze bearings encased by the hoods so as to prevent oil throwing or oil creeping. Ducts convey the oil back to the cups. The rectangular brushes used are of special composition carbon and graphite. The fan is built in 12-in. and 16-in. sizes for 110-volt and 220-volt circuits. Fans for railway and storage battery service are built for 25, 30, 60, 80 or other special

voltages. The oscillating fan is actuated by a shifting vane located inside the guard. The reversals are cushioned by the air from the blades so that jar and racking of moving parts are avoided. The fan body rotates on a special ball bearing and the electricity is transmitted from the main circuit through carbon brushes to collector rings mounted on the bearing shaft.



PEERLESS UNIVERSAL FAN.

The switch in the base of the fan affords two speeds. The ceiling fans are of the four-blade type intended for 110-volt, 170-volt, 220-volt, 250 volt and 500-volt circuits. Ventilating fans built in sizes of 18 in. to 48 in. and smaller units of 12 in. and 16 in., together with a line of column fans, complete the company's line.

Bates Electric Fans.

The fans built by the D. L. Bates & Brother Company, Dayton, Ohio, are intended for operation on direct-current circuits only. Three types of ceiling fans, a column fan and three sizes of desk fans are manufactured by the company. The desk fans are of the universal type and each is provided with a rheostat permitting three speeds. The armatures of the ceiling fans are large and well-ventilated and of the slotted type with form-wound armature coils. The field coils are also form-wound and are slipped over the six poles used and wedged in position. The distribution of both the field and armature coils is such that ample heat radiation is provided. Anti-friction and inter-pole bearings are employed, the lower bearing being self-adjusting by the weight of the armature. Round carbon brushes are employed which protrude through openings in the lower motor cover so that renewals may be made without removing the blades or the motor cover. The "imperial" and "electrolier" ceiling fans are built for 110-volt and 220-volt circuits only, while the "Style E" fan is built for 110-volt, 220-volt, 250-volt and 500-volt circuits.

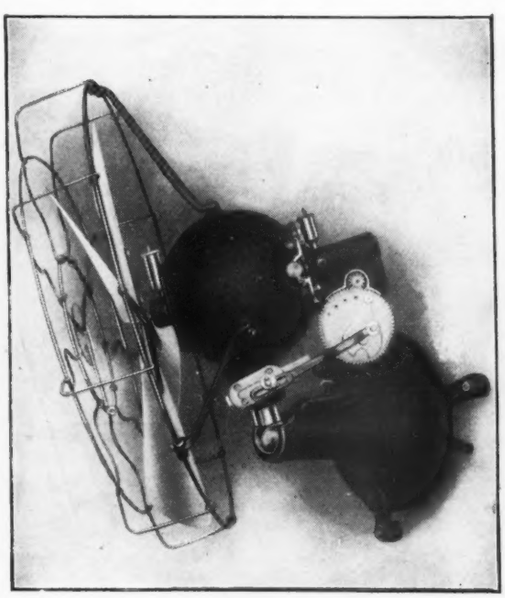
Eck Fan Motors.

The Eck Dynamo & Motor Company, of Belleville, N. J., builds direct-current motors of the oscillating and universal desk type. The Eck "Hurricane" universal fans are made with an adjustable ball joint which allows them to be tipped forward at an angle of 15 deg. from the horizontal and also to be used as bracket fans. The fan is built in 16-in. and 12-in. sizes and for voltages not exceeding 250 volts. The motor is the same as used in previous years, with grease lubrication, square brushes, bronze bearings, and three-speed rheostat. The company's oscillating fan is shown below.

Diehl Electric Fans.

The line of fans placed on the market by the Diehl Manufacturing Company, Elizabethport, N. J., is the same this year as last, with the exception that the 9-in. desk fan will be discontinued and a new 8-in. fan will take its place. The oscillating fan built by the company is provided with the split ball feature used in the universal fans and may be adjusted in the same manner for desk or bracket use. The oscillating fans are made with 12-in. and 16-in. blades and are provided with rheostats giving the usual three speeds. Differential gears, which are enclosed in a case filled with oil, impart oscillating action from the motor shaft. The case revolves slowly by virtue of this mechanism and carries rubber-faced studs on a portion of its periphery. The bracket carries the motor on ball bearings and is arranged to form ways upon which the studs act by friction and give the motor the desired movement. When used as a bracket fan, the angle is fixed so that the blades are in a plane about 15 deg. from the vertical, and the air current is directed downward to that extent. The line of ceiling fans built by the company is very complete. These are made for 110-volt, 170-volt, 220-volt, 250-volt and 500-volt circuits.

BATES DESK FAN.



ECK "HURRICANE" OSCILLATING FAN.

DIEHL DESK FAN.

"Standard" Fan Motors.

The Robbins & Myers Company, of Springfield, Ohio, continues to offer its line of "Standard" fans in very much the same form as in previous years. Three styles of ceiling fans have been found necessary to meet all classes of trade. The differences between these three styles are principally differences of finish and materials used in the external parts of the fans, the internal mechanism of all three models being very much alike and consisting of a deep slotted drum armature having machine-wound coils and an iron-clad field structure, the housings or end plates of which carry the bearings for the armature. Suitable oil cups are carried by the armature shaft in such a way as to supply, cleanly and copiously, lubrication to the bearings. In two styles switches are provided for controlling the speed of the fans by means of a suitable resistance coil mounted inside of the motor body.

For use on alternating current but one type of ceiling fan is offered, this being a motor of the induction type provided with self-lubricating ball bearings and speed-regulating switch. The maximum speed on all ceiling fans is approximately 200 r.p.m., which speed can be reduced practically 50 per cent by means of the switch supplied as part of the fan.

The company offers a full line of 12-in. and 16-in. desk fans for both direct and alternating current, these being provided with swivel and trunnion movements for adjusting the direction of the air current. A smaller fan, known as the residence type, is furnished in every way like the larger motors and is supplied for either alternating or direct current. This motor is of the commutator type, and has been found entirely satisfactory for the cooling and ventilating of residences and rather limited areas.

The "Standard" oscillating fan with both direct- and alternating-current motors is one of the company's best products. The oscillating movement of these fans is obtained by means of the unsymmetrical air reaction due to the presence in its path of a brass disk or vane which automatically changes its position at the end of its oscillation.

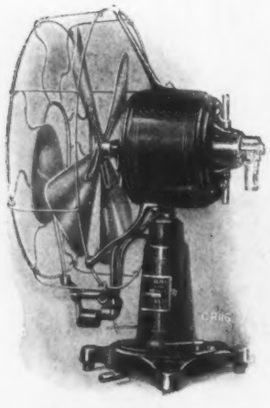
Convenient and satisfactory mounting arrangements have been made for the 12-in. and 16-in. fan motor bodies for all currents so that they may be utilized as exhaust fans for the ventilation of moderate areas requiring fresh air as well as a circulation of the air in the room. These exhaust fans may be readily mounted by covering a suitable aperture in the apartments with a board having a circular opening the size of the fan blades and fastening the exhaust fan by its ring to this board with four wood screws. The company also builds larger types of exhaust fans, up to 42 in. in diameter, for both direct and alternating current.

Century Alternating-Current Ceiling Fans.

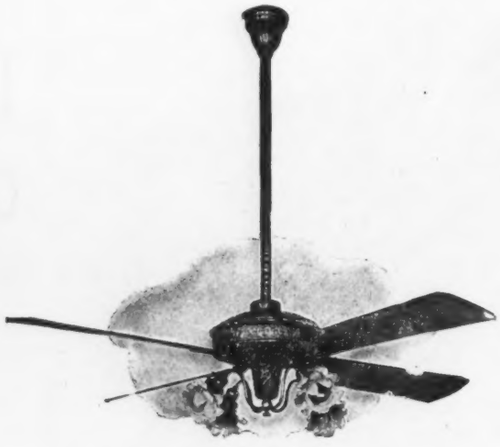
The Century Electric Company, of St. Louis, Mo., manufactures alternating-current ceiling fans exclusively. These are built for any tension between 90 volts and 250 volts and for any frequency between 25 cycles and 67 cycles. The fan can be taken apart for cleaning or inspection without having to disconnect a single wire. It is an economical energy consumer, moves a maximum quantity of air and operates practically noiselessly. The 60-cycle fans operate at a speed of 225 r.p.m. and at a corresponding speed when the frequency varies. All fans are equipped with a two-speed switch, the low speed being about 180 r.p.m. on 60-cycle circuits. Both the two-blade and the four-blade fans have a sweep of 58 in. Two-lamp or four-lamp electroliers may be attached to the oil cup of the fan when so desired. The bearings and shaft are accurately fitted so that there is no binding or sticking, and the whole weight is supported on hardened steel ball bearings immersed in oil. The fan is oiled by simply unscrewing the oil cup and pouring in the oil. The construction is such that the throwing of oil is said to be impossible.

Oscillator and Base for Electric Fans.

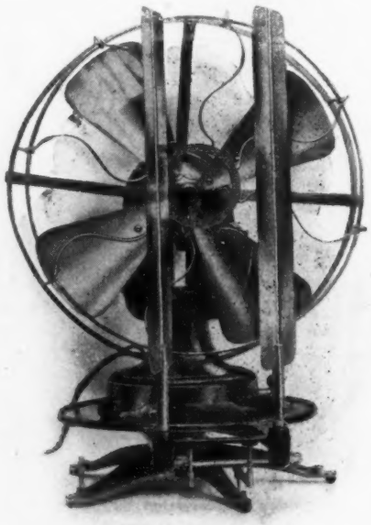
It is generally recognized that for very many conditions an oscillating electric fan or a fan guard giving the same air distribution is preferable to a fan blowing air in one direction only. In order to impart to the stationary electric fans all the advantages of the oscillating fan, the Simplex Manufacturing Company, of New York, has brought out an oscillator especially applicable for this purpose. The oscillator is a purely mechanical device operating on well-known principles. As shown in the illustration herewith, the fan is placed on a round table which oscillates freely on ball bearings and the adjustments are such that the arc through which the fan swings can be made as large as desired. The impetus to move is communicated to the table by the fan itself. Mounted on the table are two parallel vanes set at an angle, and the air from the fan impinging against these vanes causes the table to revolve until its reversing mechanism comes in contact with a setting in one of the feet of the device, when the vanes are turned and the movement of the table is reversed. No special skill is required in adjusting the oscillator to the fan, as will be inferred from the engraving. The device is made in two sizes which will very easily accommodate all electrical fans in common use.



ROBBINS & MYERS "STANDARD" OSCILLATING DESK FAN.



CENTURY CEILING FAN.



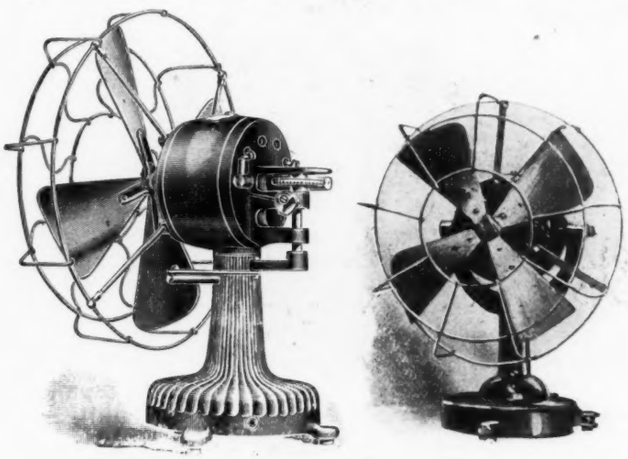
SIMPLEX OSCILLATOR AND BASE.

Fidelity Fan Motors.

To meet the demand for a fan motor of moderate price, but which would still embody thorough construction in all its parts, the Fidelity Electric Company, of Lancaster, Pa., has developed a 10-in. fan for use on direct-current circuits, in which particular attention has been paid to making the fan as efficient as possible, both electrically and mechanically. In designing the speed control, the resistance method with its attendant electrical loss has been discarded; the desired result being obtained by a simple method of field control in which at either high or low speeds all the electrical energy is used in driving the blades.

Inasmuch as the 10-in. propeller adopted is smaller than the standard 12-in. size, a specially shaped blade has been developed which is said to be very efficient in throwing the air, preventing most of the back slippage common to the older type, and bringing the 10-in. blade very close to the 12-in. breeze-producing properties. In its general construction the fan motor is well built, with wick feed oilers, copper commutator, polished brass propeller and guard, and swing trunnion attachment.

Besides its well-known direct-current oscillating fan, the company has this season placed on the market an oscillating fan

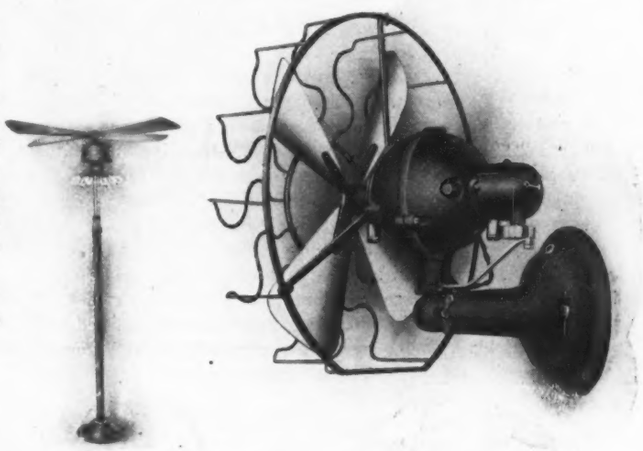


FIGS. 1 AND 2.—FIDELITY OSCILLATING AND DESK FAN MOTORS.

motor for use on alternating-current circuits, embodying the same oscillating mechanism as the direct-current fan, with a few improvements which experience has proved necessary. As this mechanism is direct driven from the motor shaft, no trouble is experienced in the operation of the fan when out of level; in fact, the operation is claimed to be satisfactory when the motor is placed at a very considerable angle, and it is often for special reasons installed in such manner.

Sprague Electric Fans.

The Lundell direct-current fans, manufactured by the Sprague Electric Company, are among the best known electric fans on the market. These fans have been kept up to date and are still very popular. The guard on the 16-in. fan this season has been slightly flattened at the bottom in order to give the fan a greater downward deflection, as shown in the illustration. A new type of Lundell fan is introduced this season in the form of an oscillating fan, for which superior advantages are claimed. The motor is durable on account of its substantial design. The oscillating movement is very simple. No small gears are used and ample lubrication is provided. The oscillating movement can be acquired or thrown out by a simple turn of the lever located on the casing which encloses the gears at the back of the motor. The arc through which the motor moves is approximately 100 deg. and the downward deflection of the desk fan is approximately 25 deg., while in the bracket fan it is approximately 100 deg. The oscillating fan is made in the 12-in. and 16-in. sizes. A very important feature in the construction of the oscillating fan is that the oscillator mechanism can be easily attached to the Lundell non-oscillating 1909-type fans. This is a distinct advantage and places the Sprague fan in a field by itself. In addition to these fans and the Type-T ceiling fans the Sprague Electric Company is placing on the market this season attractive floor and counter column fans. These fans, like the ceiling fans, have four wooden blades 8 in. wide with a sweep of 56 in. The blades are of polished white wood and are firmly

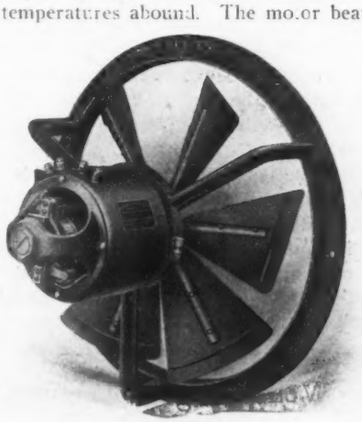


FIGS. 1 AND 2.—SPRAGUE COLUMN AND OSCILLATING FANS.

riveted to the holder, which, in turn, is screwed and locked to the fan spider. The floor and counter column fans, like the ceiling fans, have been designed with a view of making them efficient, durable and attractive in appearance, and are furnished in both plain and ornamental types.

Rochester Ventilating Fan.

The ventilating outfit of the Rochester Electric Motor Company, of Rochester, N. Y., is designed to meet the severest service encountered in practice. The motor is series wound and its temperature rise under normal conditions is 25 deg. C. above that of the surrounding air, allowing ample leeway for installations of fans in engine rooms, kitchens and other places where high temperatures abound. The motor bearings are un-



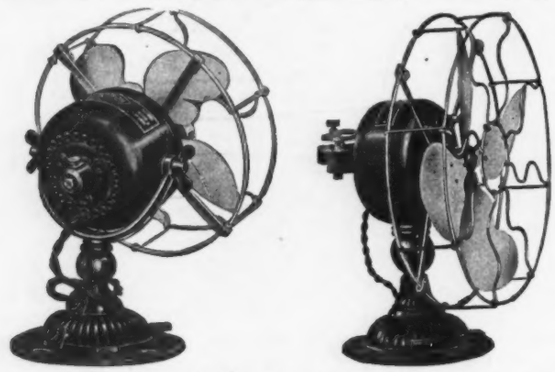
ROCHESTER VENTILATING FAN.

usually large and are practically dustproof. The bearing itself is of bronze and of the ball-and-socket type, one-half of the ball resting on a spherical seat integral with the supporting bracket and the other half seat being an adjusting cone held in place by locknut and key, the fraction of a turn more or less compensating for any variation that might exist in the size of ball on different bearings. The oil wells are deep enough to permit any foreign matter that might possibly work itself in to settle to the bottom, allowing the rings to furnish clean oil

to the bearings. Provision is made to oil the bearings on the fan-end of the motor without danger of coming in contact with the blades of the fan. Where desired the motors can be entirely enclosed. The peculiar feature of the fan is the curve of the blades, which is such as to give nearly uniform velocity across the entire face of the fan. This makes it possible to work against greater back pressure than usual with the disk type of fan and also permits the fan to handle a larger column of air for the same diameter.

Emerson Alternating-Current Fans.

This year the Emerson Electric Manufacturing Company, of St. Louis, Mo., offers the same large assortment of induction desk and ceiling fans as heretofore, with the addition of two new types. These are an 8-in. swivel-and-trunnion fan and an oscillating fan. The 8-in. fan has become popular for home use and for small rooms, although not displacing the larger fans for general service. It is identical in design with the company's 12-in. motor and has an induction motor without brushes or commutator and with an automatic starting device. The motor has the high-efficient form of winding and hardened steel shaft which are familiar to users of Emerson fans, and is fitted with the patented blades adopted by the company. The latter are fastened to the armature in the same manner as in the older

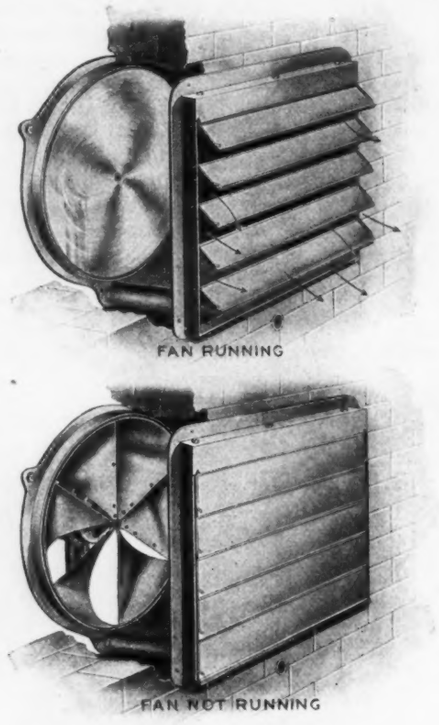


FIGS. 1 AND 2.—EMERSON 8-IN. DESK FAN AND OSCILLATING FAN.

types, making an oil-tight, dust-proof bearing which, it is said, cannot throw oil. The convertible base of the 8-in. fan permits it to be changed into a bracket fan, and the usual swivel-and-trunnion adjustments are provided. The fan has but one speed, 1650 r.p.m. The oscillating fan has a special convertible bracket base and ⅜-in. revolving steel shaft and bronze bearings, owing to the requirements of the oscillating design. The oscillating or lateral swinging movement is secured by a worm-gear attached to the rear end of the shaft, operating an adjustable lever arm which swings the fan gently from side to side. The oscillating device is positive in its action and operates with the fan in any position. Although the fans do not have the usual trunnion, the base is so designed that the fan may be tilted or depressed. The oscillating fans have but one speed. Two sizes of fans are built, 12 in. and 16 in., and the speeds are 1650 r.p.m. and 1850 r.p.m., respectively.

Ilg Ventilating Apparatus.

The Ilg Electric Ventilating Company, of Chicago and New York, has brought out an automatic shutter to be used in connection with its well-known self-cooled exhaust fans. The accompanying illustration shows the fan installed in a brick wall connected with one of these shutters. The upper part of the engraving shows the fan while running and the lower part shows the fan at rest. The shutter consists of several horizontal aluminum slats pivoted into a rigid frame and hanging free in front of the exhaust vent. The slats are arranged so that when hanging down they overlap each other, fitting closely, thus effectually preventing the ingress of sweeping winds, draughts or rain that otherwise frequently cause annoyance by blowing in through the unprotected vent when the fan is not operating. The shutters are forced open by the pressure of the air current from the fan when the latter is running and drop shut automatically by gravity when the fan is at rest. No attention is required by the shutters and the slats, being of aluminum, are not affected by any kind of weather or salty atmosphere. The method of ventilating the motor is indicated in the engraving.



ILG VENTILATING APPARATUS.

The motor is entirely enclosed and the vacuum created in the front of the center of the fan when the latter is in operation causes the cold air from outside the motor to pass through the tube connecting with the hood enclosing the motor and out with the general exhaust. In this way the motor is protected from dust and other foreign matter and is not reduced in rating owing to being enclosed.

Westinghouse Fan Motors.

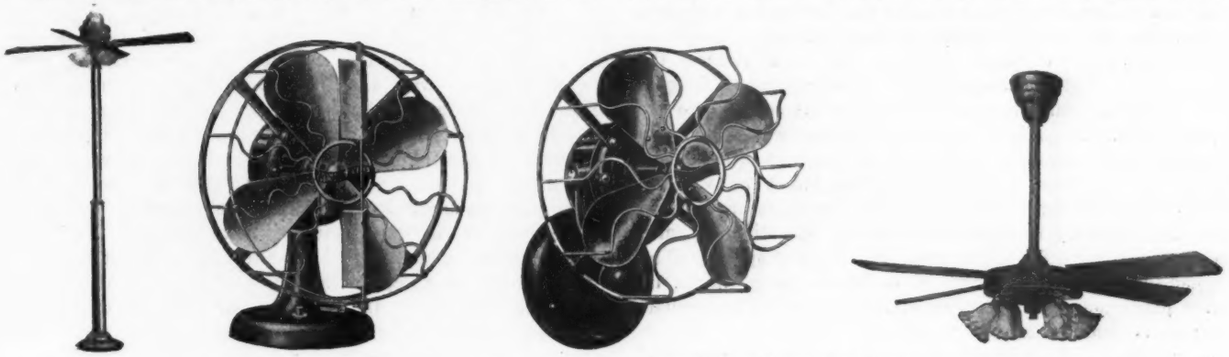
The 1909 fan motors of the Westinghouse Electric & Manufacturing Company include numerous types and sizes adapted to all kinds of commercial circuits and to any class of service to which fan motors may be applied. In addition to the standard lines of fans listed last season, several new models are presented, including 8-in. desk fans, telephone-booth fans, ventilating, oscillating fans, etc.

The direct-current fan motors are characterized by lightness in weight, noiselessness in operation and high efficiency. The frames are cylindrical, made of cast iron, and have rectangular pole pieces and field coils. The armature is of the drum type, built up of laminated sheet steel mounted upon a carefully ground tool-steel shaft. Especial care has been used in the design of the commutator so as to eliminate commutating troubles. The ceiling and column fan motors are provided with ball bearings to carry the weight of the moving part, and friction is reduced to an almost inappreciable amount.

The alternating-current fan motors are of the induction type, except the 8-in. and telephone-booth fans, which have series windings. The frames are well ventilated, and the stators and

rotors are built up of specially annealed sheet-steel laminations. The shaft is of hardened tool steel running in bushings of the best bearing metal, and the bearings are self-oiling with automatic oil returns to prevent oil-throwing.

The 8-in. desk and telephone-booth fans are designed to run with absolute quietness and to furnish a moderate circulation of air for bed chambers and other places where a strong breeze would be objectionable. A switch is placed in the base of the motor by means of which it is started, stopped and given three speeds. The telephone-booth fan is adjustable in both the horizontal and vertical planes and suspended by springs to dampen any vibrations which might affect the telephone. The energy required to operate these fans is only about one-third of that consumed by an ordinary 16-cp lamp.



FIGS. 1, 2, 3 AND 4.—WESTINGHOUSE COLUMN, OSCILLATING, BRACKET AND CEILING FANS.

The ceiling and column fans have four blades. A number of tapped holes directly under the fan blades are provided to accommodate standard nipples or arms for electric light fitting; either two, three, four, five, six, ten or twelve lamps may be so used. The lamps are thus below the blades, so that the latter cast no shadows on articles below. The energy consumption of the motor is less than that required for three standard 16-cp lamps.

The ventilating fans differ from the desk and bracket fans in the method of mounting employed. They are designed to act as exhaust fans for the ventilation of rooms and enclosures, and consist of 12-in. and 16-in. fan motors supported on ring frames suitable for mounting in wall openings.

For places where it is desired to disperse the breeze from an electric fan over a wide area, the Westinghouse company is introducing an oscillating fan which is positive in action and of very simple construction. The oscillating device used on these fans requires a very small amount of energy. As shown in the illustration, a vertical rod free to revolve through a quarter revolution is supported in front of the fan guard, and to this rod are fastened two pairs of auxiliary blades, each pair consisting of two blades set at right angles to each other. To the bottom of the vertical rod is connected a short lever, which, as the fan oscillates, strikes cushioned stops fixed on the base of the fan, at any desired point, thus turning the rod with its blades through a quarter revolution at the end of each oscillation. The turning of the rod throws the auxiliary blades alternately parallel to the fan blades, first on one side and then on the other side of the center of the fan, and the reaction of the air upon the auxiliary blades causes the fan to turn alternately from side to side. The body of the fan is supported on ball bearings, so that it revolves freely on the slightest impulse. One valuable feature which eliminates any chance of accident from twisted leads is the transmission of the electricity from the base to the oscillator by means of brushes and collector rings.

Western Electric Fan Motors.

The line of fan motors and ventilating outfits offered by the Western Electric Company for the 1909 fan-motor season includes desk, bracket, oscillating, ceiling, telephone-booth and exhaust fans in a wide range of designs and for operation on all commercial direct-current and alternating-current circuits. Some slight changes have been made from 1908 models where improvement has been found possible and new types have been added. In the direct-current desk and bracket type the "Universal" is furnished in 12-in. and 16-in. sizes. The "Zero," which is a desk type only, is also furnished in 12-in. and 16-in. sizes. Both these fans can be operated at three speeds. The "Universal" is totally enclosed, while the "Zero" is of the open field type.

The 8-in. "Hawthorn" is a new combined desk and bracket fan and is furnished for both direct-current and alternating-current use. It is a three-speed fan which is highly desirable for residential use as well as in small offices. The energy consumption of this fan is said to be very low. Another 8-in. type is the telephone-booth, spring-suspension fan motor. This model has been improved since last season and in addition to being used in telephone booths is being used for mounting on light partitions, since the spring suspension eliminates vibration. The fan is built for direct and alternating current.

FIGS. 1, 2, 3 AND 4.—WESTERN ELECTRIC TELEPHONE, BRACKET, CEILING AND EXHAUST FANS.

In addition to the "Victor" oscillating fan, which is supplied in both direct-current and alternating-current types, a new direct-current oscillating fan is now being offered. This is

known as the "Universal" and is of the desk and bracket type. In its design advantage has been taken of the fact that the strongest air currents are at the edge of the blades, with the result that a smaller vane is used than ordinarily. The unbalanced conditions in the air currents produced by the vane cause the fan to rotate on a vertical axis through a wide arc. The vane is held in a horizontal position by a trigger which on striking a stop at the end of the path of travel releases the vane and permits it to rotate through 180 deg., where it is again held in a horizontal position until the fan has returned to the opposite stop. The vane is carried on a collar which is loosely mounted on the armature shaft and, as the vane is in perfect balance, the slightest amount of friction causes it to rotate when released by the trigger. No sliding contacts are used to carry the electricity from the stationary to the oscillating part; the electricity being fed to the motor by means of springs. The mechanism of this fan is claimed to be extremely simple, its action positive and its operation highly efficient. The oscillating part is mounted on ball bearings.

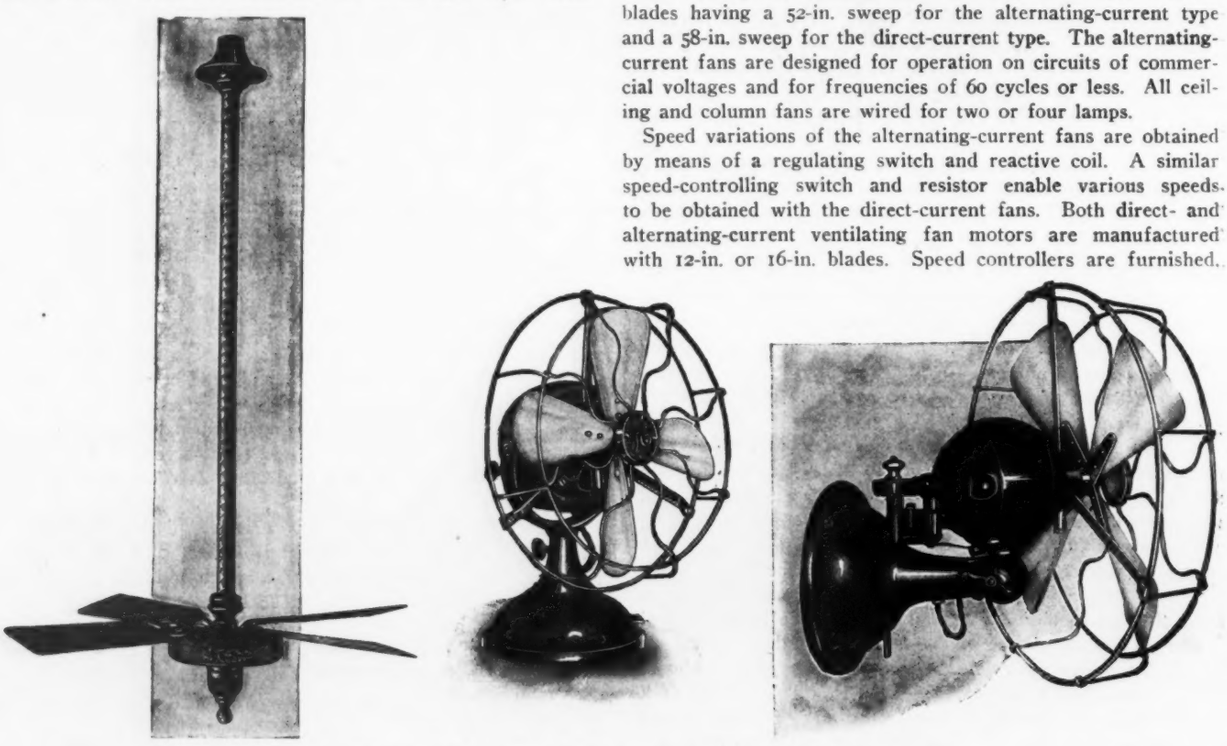
A combined desk and bracket fan for alternating current is the "Victor," which is furnished in 12-in. and 16-in. sizes. the motor is designed to operate. The mechanism is arranged so as not to interfere with the convertible feature of the motor, by means of which it can be quickly adapted for either desk or wall use.

Desk and oscillating fans, as usual, are furnished in all different types for standard voltages and frequencies, or can be wound to meet special requirements if desired. Both direct- and alternating-current fans of the desk or oscillating type can be obtained with 12-in. or 16-in. blades. These, with the bracket-type fans of the same design and sizes, are available for all classes of service. An advantageous feature in connection with the direct-current desk motors is the universal joint with which they are equipped and by means of which a desk motor may be instantly transformed into one of the wall-bracket type, or vice versa, without the aid of tools.

The wall and desk types of the alternating-current fans are identical with the exception that the wall type has an angular adapter in addition to the standard parts of the desk type. This adapter enables the fan to be turned so as to utilize the breeze to the best advantage.

The ceiling and column fans are fitted with four wooden blades having a 52-in. sweep for the alternating-current type and a 58-in. sweep for the direct-current type. The alternating-current fans are designed for operation on circuits of commercial voltages and for frequencies of 60 cycles or less. All ceiling and column fans are wired for two or four lamps.

Speed variations of the alternating-current fans are obtained by means of a regulating switch and reactive coil. A similar speed-controlling switch and resistor enable various speeds to be obtained with the direct-current fans. Both direct- and alternating-current ventilating fan motors are manufactured with 12-in. or 16-in. blades. Speed controllers are furnished.



FIGS. 1, 2 AND 3.—GENERAL ELECTRIC CEILING, DESK AND OSCILLATING FANS.

These fans are of the induction type, are of neat and strong construction and operate at three speeds. The line of ceiling fans includes a number of plain and highly finished types for direct and alternating current. All these fans are finished to operate on 110 volts, 220 volts or 500 volts. The "Victor" for alternating current is furnished plain or ornamental, the former in two and the latter in three speeds. The company's exhaust fans are equipped with motors best adapted to that particular style.

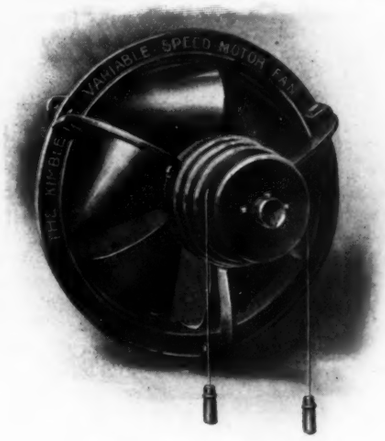
General Electric Fan Motors.

With the exception of a few slight changes the fans placed on the market this year by the General Electric Company are identical with those of last season. A line of oscillating fans has been added, but the fans, with the exception of the oscillating features, are identical with the corresponding fans of the standard types. The oscillating fans have a positive oscillating mechanism actuated by a worm on the armature shaft. This insures a uniform oscillating movement at all speeds at which however, only with the direct-current type. These fans are designed to be installed in the exhaust openings.

In the design of fan blades for the 1909 model motors, a departure from the conventional form has been made. The usual design consists of a triangular-shaped blade with a constant pitch at all points riveted to a narrow arm of the carrier. Blades of the new design are wider at the hub end than the ordinary blade and have a pitch increasing to a maximum at this point. The corners of the blades are also rounded off and ample space is provided between the fan and the motor body. The blades are made of extra heavy brass formed to shape under heavy pressure and riveted to a rigid spider. The result is a very rigid fan that is free from vibration and consequent noise. The guards are heavy and durable and are supported in such a manner that it is impossible for them to shift or work loose. No solder at all is used to hold the cross wires. This construction gives a stiff and effective guard by which the motor can be lifted without danger of distorting or breaking any of the parts, thus providing a convenient method of handling the fan.

Kimble Variable-Speed, Single-Phase Ventilating Fan.

The Kimble Electric Company, of Chicago, builds a variable-speed, single-phase ventilating outfit which is claimed to combine many advantages. Gradation in speed between the maximum and the minimum is accomplished by means of two pendant chains, as shown in the engraving, which also illustrates the older method of mounting the motor to the frame. In the newer method the frame is all in one piece. The fan is made in



KIMBLE VENTILATING FAN.

three sizes, 18-in., 24-in. and 30-in., the respective speeds ranging from 80 to 800 r.p.m., 75 to 750 r.p.m. and 70 to 675 r.p.m. The motor used is of the variable-speed, single-phase type. The speed-control mechanism is enclosed within the motor casing and variation in speed is accomplished by shifting the brushes. The energy consumed follows the load closely. Full line voltage may, it is claimed, be impressed upon the motor while it is standing still without danger to the windings. The starting current is not larger than the running current, and the entire equipment is ideally simple. The fan used is of the Blackman type.

Fort Wayne Fan Motors.

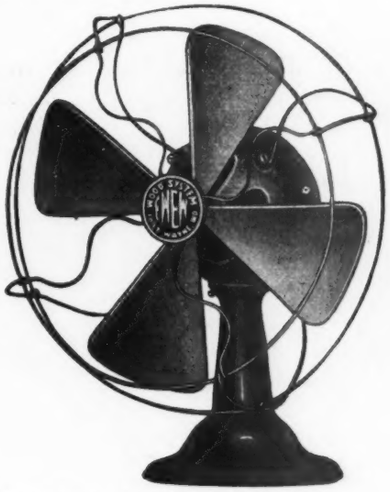
Several new and interesting features are noticeable in the Fort Wayne Electric Works' line of fan motors for the season of 1909. These features have been added as a result of the popular demand for a reliable, useful, efficient fan motor. The company has increased its standard line by the addition of new types and sizes of fan motors. The standard line of 8-in. fan motors is maintained with improvements in minor details. The 8-in. fans comprise the solid base desk fan. The universal bracket fan motor has a standard motor body, but is supported by a brass goose-neck bracket fastened to it and held by a suitable lug mounted on the wall. The fan is adjustable both vertically and horizontally. The suspended revolving fan motor is designed to hang from an ordinary incandescent lamp socket and revolves horizontally around its support, thus throwing air to all parts of a room at regular intervals. The telephone booth fan motor is also of the 8-in. size and is especially designed for such service. It is small, light running, noiseless and of somewhat slower speed than the standard 8-in. fan motor. All of the fans are made for both alternating-current and direct-current service.

The line of 12-in. and 16-in. fan motors consists of a desk and wall bracket type for direct current. This fan may be used either as a desk fan or it may be mounted on the wall. It is adjustable horizontally and is made in both sizes. The corresponding fan for alternating current is known as the swivel and trunnion type, and is also made in both 12-in. and 16-in. sizes. This fan may be used either as a desk or wall bracket fan and is adjustable both vertically and horizontally.

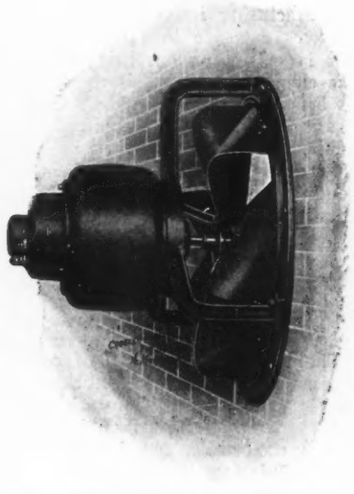
An entirely new line of oscillating type fan motors is made in both 12-in. and 16-in. sizes for both alternating and direct current. The special feature of these fans is the simple automatic arrangement which swings the motor body and fan horizontally through an angle of 90 deg. at regular intervals, thus throwing the air to every part of the room. This fan may be used either as a desk or wall bracket fan, the oscillating feature being adapted for either use.

Crocker-Wheeler Ventilating Fans.

The only type of fan at present built by the Crocker-Wheeler Company, of Ampere, N. J., is designed for ventilating purposes, for heating in connection with steam-heating systems and for drying lumber, hides, textiles and other materials. The outfit is also applicable for laboratories and chemical works for withdrawing noxious fumes and gases. The fan may be attached to the wall or ventilating duct and may be operated in a vertical position. The stock sizes are 18 in., 24 in., 30 in. and 36 in. The motors are generally of the open type, but when the fan is to operate in a moist or dusty atmosphere enclosing covers are supplied. The motors are of the company's Form L type and are direct-connected by substantial arms to the wall ring. The armature shaft carries a propeller type of fan of the latest design. The speeds range from 900 r.p.m. in the smallest fan to 500 r.p.m. for the largest fan. The entire line is built for 115, 230 and 500 volts.



FIGS. 1 AND 2.—FORT WAYNE OSCILLATING AND DESK FAN MOTORS.



CROCKER-WHEELER VENTILATING FAN.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

During the past week there has been some slight expansion in the trade of jobbing houses, especially in the lines of dry goods and millinery. There has also been the active business in agricultural implements and fertilizers customary at this season of the year. The manufacturers of cotton and woolen goods continue to report that they are practically running up to full capacity and that they are having difficulty in keeping up with their orders. With these exceptions, however, it may well be stated that the present condition of trade is about as unsettled as has been known in many years. The demoralization in the iron and steel business, the suspense concerning the tariff, the crisis that exists in the copper producing industry, the weakness in the security market and the excitement and uncertainty that are being created by the wheat corner in Chicago all contribute to make business conditions extremely unsatisfactory. There is little prospect that they will be much more settled until after the tariff schedules shall have been finally agreed upon. Capital is timid, and conservative business men are unwilling to invest or to expand as long as there remains an uncertainty as to what future price bases will be. The constant reiteration that there will be an open market in all the metal trades leaves both sellers and buyers in a state of doubt as to the future. During the past week the weather conditions in the West contributed to the dullness of retail business. The country roads are in such bad shape in many sections that purchasers could not get to market and the farmers' deliveries of grain and other products to the railways were seriously impeded. The electrical industries are, of course, feeling to a considerable extent the general suspension of business, but they are in no worse condition than the majority of the other manufacturing interests. Sales of small apparatus and appliances continue in fair volume, but there are few orders for large installations being booked. The most active of all the electrical branches is the lamp trade, and this is reported as being exceptionally good. Collections continue to be about in the same condition as existed for several months. They are neither as good as creditors would desire, nor are they slow enough to cause any serious inconvenience. The financial condition of the majority of the retailers throughout the entire country is better than it has been for a long time, due, of course, to the 16 months of ultra-conservatism. Business failures for the week which ended Feb. 25 were 244, against 282 the previous week, 311 in 1908, 194 in 1907, 180 in 1906, 206 in 1905.

THE COPPER MARKET.

The February movement of copper indicates that there has been a further increase of stocks to the extent of about 30,000,000 lb. The production for the month, including imports, has been apparently 105,000,000 lb. The exports were not more than 35,000,000 lb., and domestic consumption has been rather less than during the previous month, when it was a trifle more than 40,000,000. Thus it is not hard to figure that the surplus has been considerably augmented. The figures offered by the Copper Producers' Association for Feb. 1 showed that there were 144,000,000 lb. of "marketable" copper in the hands of producers. These figures were generally accepted as being at least 50,000,000 lb. below the actual surplus of copper in the country, and the saving clause was supposed to be found in the term "marketable." Taking the producers' figures, however, as a basis, it is apparent that the March 1 report will show something like 175,000,000 lb. of "marketable" copper in sight. At the present time the refineries are keeping up fairly well with the smelters, and it is probable that the copper called "marketable" will in the future more nearly represent the actual amount of metal mined. Of course, there will always be large quantities in process of smelting and refining, and these stocks can only be estimated in the broadest manner. During the week which ended Feb. 27 the price of copper sagged continually, and there was an almost entire absence of purchasers. The marking down of prices seemed to have no effect upon consumers. Inquiries for electrolytic were as few when the quoted price was 12¼ as they had been when the price was above 13 cents. The reason for this is very plain. The business of the electrical companies is not more than 60 per cent of normal, general trade conditions are unsettled by the tariff, copper statistics indicate lower prices and the prudent buyer very naturally sees the wisdom of waiting. In the London market the heavy decline has induced some speculative buying, but the demand for consumption continues to be light. On March 1, there was some stir in the market and reports were given out from all selling quarters that big sales were being negotiated and inquiries were pouring in. One statement, which was not so secretly made that any newspaper in town failed to get it, declared that the electrical companies had bought from 30,000,000 lb. to 50,000,000 lb. during the day. Another agency declared that it had received more inquiries during the day than during the previous three months. This tremendous change for the better came almost too suddenly to be greeted with credulity throughout the copper market. It was openly intimated that the instantaneous revival had more to do with Wall Street than with the metal market; that it was intended for the dealers in stocks, not the dealers in copper. Prices, however, were certainly stiffened up a bit by the movement, and there was less willingness to grant concessions below quotations. Prices, however, did not recover as much as it would be proper to expect in the presence of a 50,000,000 lb. sale. To sell in one day more copper than was sold to consumers in any one of the past three months ought to have a very radical effect on prices. Exports from New York during the month of February were 13,869 tons. The prices quoted on the Metal Exchange March 1 were:

Lake	12¾	@	13
Electrolytic	12⅜	@	12⅝
Castings	12¼	@	12½

London quotations were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	57 5 0	57 7 6
Standard copper, futures	58 0 0	58 2 6
Market	Strong.	Firm.
Sales of spot		500 tons
Sales of futures		1,900 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.25	12.75
Electrolytic	14.25	12.37½
Casting	14.12½	12.25
London, spot	£64 2 6	£55 17 6
London, futures	64 17 6	56 12 6
London, best selected	67 15 0	59 10 0

NILSON-MILLER COMPANY.—The Nilson-Miller Company, of Hoboken, N. J., has been incorporated with capital of $25,000. It is located at 1300 Hudson Street, in the shop formerly occupied by W. D. Forbes & Company, and will conduct an engineering and general machine-shop business, making a specialty of designing and building to order electrical apparatus, gasoline engines, etc., for commercial vehicle, marine and stationary use. Experimental work and the manufacture of special machinery will also be undertaken.

BUSINESS PROSPECTS IN THE NORTHWEST.—Sales Manager Allen L. Haase, of the Harvard Electric Company, Chicago, states that in a recent trip covering part of the great Northwest, and particularly Iowa and Nebraska, he found all through this territory a buoyant feeling among the business men that seems to assure a good volume of business from that entire section this year and he was especially pleased with the condition existing all through this great agricultural belt.

MACHINE TOOL CONSOLIDATION.—The Bickford Drill & Tool Company, of Cincinnati, and the Cincinnati Machine Tool Company have consolidated under the title of the Cincinnati-Bickford Tool Company. The officers of the new company are as follows: August H. Tuechter, president; Sherman C. Schauer, vice-president and general manager; W. H. Shafer, secretary; G. P. Gradolf, treasurer; H. M. Norris, mechanical engineer.

WESTINGHOUSE TURBINES.—The Portland Cement Company of Portland, Col., has purchased a 600-kw, three-phase, 60-cycle Westinghouse turbo-generator equipment, with Le Blanc condenser, a rotary converter and a switchboard. The installation of Le Blanc condenser makes it possible to utilize for condensing purposes water from an old well, which is not now usable with the present type of surface condenser. Turbines have been adopted in this plant for power extension rather than Corliss engines, two of which have already been operating for a number of years on surface condensers. With the moderate superheat and high vacuum contemplated, it will thus be possible for the turbine to effect considerable economy in operation. Although direct current is largely used at this plant, an alternating-current turbine unit was selected in connection with a rotary converter as providing greater flexibility of operation than obtainable with a direct-current turbine unit, which was also under consideration. The Lyman Mills, at Holyoke, Mass., have purchased a 750-kw, two-phase, 30-cycle, 440-volt turbo-generator. For some years Westinghouse induction motors have been installed throughout the mill to drive the various machines, with a total capacity of 900 hp. Recently the company decided to install additional generating capacity, and to this end made the present purchase.

FLAMING ARC BUSINESS CONSTANTLY INCREASING.—While business in many lines of electrical development is far from booming, there is certainly no reason to complain with regard to the trade in flaming arc lamps. The main trouble importers and dealers are now having is to keep up with their orders. Speaking of this rush of business, Mr. L. J. Auerbacher, of Fox Brothers, New York, said: "The country is just waking up to the value of the flaming arc lamp, and business and inquiries are pouring in from every quarter. Not only are big factories, foundries and other industrial plants turning out the flaming arc as the most satisfactory and economical method of lighting, but municipalities all over the country are realizing that here is a method of street lighting that excels anything heretofore devised. The flaming arcs really light the streets, and this has never been done before. There are many instances where the citizens are insisting upon the use of these lamps, and are willing to stand an extra tax in order that they may be installed. We have on hand now a deal with a city involving 4000 lamps, and there are many others pending. Railroads, too, are taking up the flaming arc for station lighting. The Boston & Albany, for instance, has recently equipped the most important of its Massachusetts stations with these lamps."

TO CONSTRUCT SEATTLE SUBURBAN RAILWAY.—The Seattle-Everett Interurban Railway Company and the Everett Railway, Light & Water Company have contracted with the Stone & Webster Engineering Corporation, Boston, for the construction of an interurban railway from Halls Lake to Everett, a distance of 13 miles. There is already built a 9-mile section of interurban railway between Seattle and Halls Lake and this, together with the new section, will form a through interurban connection between Seattle and Everett. The Seattle Electric Company will provide the connecting line between the interurban at the city limits and its own system. The road will be built entirely on private right-of-way. Catenary overhead construction will be used and energy will be supplied from a substation to be located half-way between the Freemont substation of the Seattle Electric Company, in Seattle, and the power station of the Everett Railway, Light & Water Company, in Everett. The Freemont substation receives energy from either the Puyallup water-power plant or the Georgetown turbine station. From this substation the energy will be carried at 13,000 volts to the new substation for the interurban. The present arrangements provide for improvements in the present line from Seattle to Halls Lake as well as all the work involved on the new section.

CANADIAN TELEPHONES REDUCE RATES.—The provincial government of Manitoba, which took over the Bell telephone system a year ago, has announced a general reduction in the cost of telephone service. Business telephones are reduced from $50 to $25 with 2 cents a call in excess of a certain percentage. In the residences the rate has been cut from $30 to $20; extension telephones have been cut from $12 to $6, and two-party telephones from $30 to $18. This reduction is regarded as a vindication of the municipal operation of telephones by Canadian authorities and the provinces of Saskatchewan and British Columbia are negotiating with the Bell interests in those localities for the purchase of their plants. The Alberta government has already bought out the Bell Company.

AN IMPOSTER.—We are informed that a number of electrical firms have been approached by a swindler whose plan of operation is to represent that he is an officer of some large operating company, then work up a deal, place an order, accept it, encourage as much entertainment as possible, and finally borrow money. In one instance he gave his name as George W. Reid and in another gave the name of Phillips. He is a man of good appearance, about 50 years of age, about 5 ft. 8½ in. tall, with gray hair and mustache.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week has experienced the most violent decline that has occurred since the early days of the panic in 1907. For two days, Feb. 23-24, there was a most tremendous pressure to sell and stocks broke from 3 to 10 points. Sales mounted up to well over the million mark each day and the forced liquidation of small holders ran into the thousands of shares. The decline was led by Reading and United States Steel common, although the copper shares and their kindred, the smelters, were in close attendance. The sudden weakness was attributed, and no doubt quite correctly, to the demoralization in the steel trade caused by the breakdown in the price agreement and the belief that the Supreme Court would decide adversely to the railroads in the "commodities case." In United States Steel common, especially, the liquidation was enormous. The stock has always been a favorite with small speculators. It is one of those issues in which there is always "something doing." It is recognized as a stock of great possibilities. There is no doubt but that Steel had been pushed above 50 by careful and persistent manipulation. Large blocks of it were accumulated a year ago when it was below 30, by big financial interests—who also at the same time collected vast quantities of other low-priced stocks. The price was gradually lifted along until it was well over 50, and small dealers were apparently more active at the higher figures than they had been at the lower. Whether the principals, who bought early, have unloaded their holdings at the high figures, it is hard to say. Many people in Wall Street are of that opinion and declare that the recent break was but a "shake-down" to permit rebuying at lower figures. Whether this is true or not, the demoralization of Steel prices is enough to have caused all the trouble. The ability to pay dividends on Steel common depends on the excess profits the big organization is enabled to earn. In an open market, with prices from 20 per cent to 40 per cent lower than last year, the opportunity for excess profits does not seem to be very alluring. The report that the Supreme Court has rendered an adverse decision in the "commodities case," coming just at this time, added to the panic and made the small holders of Reading—a property largely dependent on its coal business—extremely nervous. The stock broke 10 points in a few hours. At the same time the weakness of the copper situation seriously affected Amalgamated and the stocks of the smelting companies. The evident overproduction of the metal, the sagging of the price, and the admission on the part of the producers that the accumulation was greater than had been given out, all contributed to the weakness of these stocks. There was talk of a copper war and talk of curtailment; either meant loss of earnings to the big copper companies. But the panic was short lived. Two days of heavy selling and weakness, and then prices reacted. The recovery has been almost as remarkable as the sudden scare. Prices on March 1, just a week after the liquidation began, were back at the same levels that prevailed before the break. The volume of business readily contracted into the normal condition that has existed since the beginning of the year and there has been little interest shown in the market. The flurry was not a serious storm. While there may be similar occurrences during the next few months, there is not likely to be developed any permanent trend to the stock market, up or down, until after the tariff rates are settled and business has adjusted itself to the new basis. The money market continues to be easy and rates are cheap. The demand for bonds is excellent, although hardly so insistent as it was a few weeks ago. Call money on March 1 was quoted at 2 to 2½ per cent; 90-day loans at 3¼ to 4 per cent. The quotations in the table are those of the close March 1.

NEW YORK.

	Feb. 20.	Mar. 1.	Shares Sold.		Feb. 20.	Mar. 1.	Shares Sold.
All.-Ch.	14¼	13⅞	1,900	Int.-Met., pfd.	41	41⅛	27,765
All-Ch., pfd.	45⅜	44	4,400	Mackay Cos.	72¼	71½*	600
Amal. Cop.	69	71	413,688	Mackay Cos., pfd.	71¼	70⅜	100
Am. D. T.	35*	35*	——	Manhattan Elev.	145	146*	400
Am. Loc.	51	52	12,350	Met. St. Ry.	30	25	100
Am. Loc., pfd.	112	110⅞	930	N.Y. & N.J. Tel.	115	115	110
Am. Tel. & Cbl.	78*	75*	100	Steel, com.	46	45⅛	881,213
Am. T. & T.	128¼	128½	8,800	Steel, pfd.	109⅝	110⅝	55,775
B. R. T.	69⅞	71¾	142,890	W. U. T.	67¼	66	2,200
Gen. Elec.	152½	155	3,810	West'h., com.	79¾	78	8,100
Int.-Met., com.	15	15	19,900	West'h., pfd.	118	104	5

PHILADELPHIA.

	Feb. 20.	Mar. 1.	Shares Sold.		Feb. 20.	Mar. 1.	Shares Sold.
Am. Rys.	46½*	46	——	Phila. Elec.	11⅞	11½	——
Elec. Co. of A.	11¼	11¼	——	Phila. R. T.	27⅛	27¼	——
Elec. Stor. B'ty	46*	46½	——	Phila. Traction.	92½*	92½	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	53	52⅞	——

CHICAGO.

	Feb. 20.	Mar. 1.	Shares Sold.		Feb. 20.	Mar. 1.	Shares Sold.
Chi. City Ry.	187*	187*	——	Chi. Tel. Co.	131½	129⅜	——
Chi. Rys., Ser. 1.	112½*	112½*	——	Met. El., com.	16*	16*	——
Chi. Rys., Ser. 2.	44*	44¼	——	Nat'nal Carbon.	85½*	86	——
Com. Edison.	108½	108¼	——	Nat. Carb., pfd.	118¾	118¾*	——
Chi. Subways.	26*	26*	——				

BOSTON.

	Feb. 20.	Mar. 1.	Shares Sold.		Feb. 20.	Mar. 1.	Shares Sold.
Am. Tel. & Tel.	128¾	128¾	——	Mex. Tel.	2⅜	2½*	——
Com. Tel.	125*	125*	——	Mex. Tel., pfd.	5½	5	——
Edison El. Ill.	—	253	——	N. E. Tel.	131½*	133	——
Gen. Elec.	—	155½	——	W. Tel. & Tel.	7*	7*	——
Mass. Elec. Ry.	14¼	14	——	W. T. & T., pfd.	78*	78*	——
Mass. E. R., pfd.	65¼	69	——				

*Last price quoted.
Shares sold are for week Feb. 23 to Feb. 27.

DIVIDENDS.

Laclede Gas Light Company, St. Louis, common, quarterly, 1½ per cent, payable March 15.

Copper Range Consolidated Company, Boston, quarterly, 1 per cent, payable April 1.

Galveston-Houston Electric Company, preferred, semi-annual, 2 per cent, payable March 15.

West Jersey & Sea Shore Railroad Company, semi-annual, 2 per cent, payable April 15.

General Electric Company, quarterly, 2 per cent, payable April 15.

Chicago City Railway Company, quarterly, 1½ per cent, payable March 30.

STANISLAUS COMPANY IN RECEIVER'S HANDS.—The Stanislaus Power Company of California, which is the holding company of the Stanislaus Electric Power Company, the hydro-electric proposition which has been recently taken over by the United Railways Investment Company of San Francisco, was placed in the hands of a receiver Feb. 16 by the United States Circuit Court of California. The terms of the deal with the railway company were published in the *Electrical World* of Feb. 18. The application for the receiver was made by the Knickerbocker Trust Company, of New York. The action is entirely friendly to the sale to the railway company, and Mr. George H. Whipple, the receiver, is a member of the firm of attorneys who represented in San Francisco the bondholders' committee which brought about the deal. The chairman of the bondholders' committee is Mr. S. Z. Mitchell, president of the Electric Bond & Share Company of New York, and the details of the new financing plan were worked out by Tucker, Anthony & Company, bankers at 24 Broad Street. In speaking of the receivership a member of that firm said: "The receiver is our representative, and the receivership proceedings were taken for the purpose of hastening the completion of the sale to the railway company. We think that is the quickest and most satisfactory way to accomplish the transfer of the property. It legalizes the entire transaction. The sale of the property, under foreclosure, will be made just as soon as possible; the bondholders will buy it, and the transfer to the railway company will be made upon the basis already mapped out." A petition to intervene in the suit was later granted to James K. Moffitt and others, who own 150 of the bonds. They dispute the right of the plaintiff to make the sale of the property to the railway company.

DECREASES REPORTED BY NIAGARA COMPANIES.—The combined income account of the Niagara Falls Power Company and the Canadian Niagara Power Company for the year 1908 shows total net earnings of $1,348,029, a decrease from the previous year of $50,653. The surplus for the year applicable to dividends was $157,291, a decrease of $53,382. To the expense account of the two companies was added $108,249 for improvements and betterments. President D. O. Mills says in his report that the companies have ample cash working capital in excess of their liabilities and during the year numerous additions have been made to the plants. The number of customers was largely increased during the year. In referring to the negotiations for an Anglo-American treaty to establish the basis of water diversion from the Niagara River Mr. Mills says: "The limitations imposed by the present law, which expires June 29 next, have prevented the operation of the plants of the company to their proper and normal earning capacity. In the light of the information now available to the United States Government, is is to be expected that the restrictions which may be imposed by new legislation will permit at least the full normal operation of existing plants." The report of the Cataract Power & Conduit Company for 1908 shows net earnings of $315,531, a decrease of $19,808. The surplus for the year was $209,899, a decrease of $31,637. The Tonawanda Power Company reports for the year a surplus of $29,712, a decrease of $2,511 from 1907. The Niagara Junction Railway Company reports for 1908 a surplus of $7,315, a decrease of $24,365 from the previous year.

LAKE COPPER INTERESTS CONSOLIDATED.—The final details of the deal, which was here referred to last week, between the Calumet & Hecla copper interests and H. S. Bigelow, of Boston, have been perfected and the agreements signed. All the Bigelow holdings are in the Osceola, Tamarack, Ahmeek, Seneca, Isle Royale and Laurium copper properties. The number of shares involved in the transfer amounts to 125,000 and the amount of money involved is understood to be around $8,000,000. The Calumet & Hecla pays for the above shares partly in cash and partly in notes. Some of these notes carry 4 per cent and some 5 per cent, and a portion carries a three-year maturity and the remainder a 10-year maturity. The total issue of notes will be in the neighborhood of $5,000,000. All of the litigation on the part of Mr. Bigelow will be withdrawn and the Calumet & Hecla will elect its own board of directors in the Osceola at the annual meeting, March 4. This deal is the most important development in the Lake Superior copper region that has occurred for years and puts the situation there practically under one control.

STATEN ISLAND ELECTRICAL COMPANIES.—The Public Service Commission has made public the reports of the Richmond Light & Railroad Company, the Southfield Beach Railroad Company and the Staten Island Midland Railway Company for the year ended June 30, 1908. The Richmond Light reported total earnings of $322,297, gross income of $79,242, and a deficit for the year of $8,757. Adding previous deficits, the company had a total deficit on June 30, 1908, of $109,348. The Southfield Beach Railroad reported total earnings of $7,375, gross income of $3,058, and a surplus for the year of $3,058. Its total surplus on June 30, 1908, was $9,489. The Staten Island Midland Railway reported total earnings of $233,949, gross income of $39,837, and a deficit for the year of $10,162. Adding previous deficit, the company had a total deficit on June 30, 1908, of $32,083.

NATIONAL CARBON COMPANY PROSPERS.—The report of the National Carbon Company for its past fiscal year, which ended Jan. 31, 1909, shows that it was the most prosperous in the history of the company. The gross earnings and expenses are not given out, but the net earnings are stated to be $980,283, an increase of $55,481. After paying a 7 per cent dividend on the preferred and 4 per cent on the common stock there was a balance of $445,283. From this was deducted $407,019 for depreciation, which is the most liberal sum the company ever charged off for this purpose. There was added to the surplus account $38,264. As the consumers of the products of the National Carbon Company are largely public service companies and telephone manufacturers, the commercial depression had less effect upon its business than upon many other industries.

AMERICAN GAS & ELECTRIC COMPANY.—The report of the American Gas & Electric Company, which controls quite a number of public-service companies in the East and Middle West, for the quarter ended Dec. 31, shows quite a satisfactory increase in net earnings. The earnings of its operating companies were $652,364, an increase of $112,002 over the corresponding period of 1907. After providing for the dividend on the preferred stock and all other expenses and charges, the surplus for the quarter is $66,519, as compared with $22,463 the previous year.

TENNESSEE COPPER COMPANY.—The annual report of the Tennessee Copper Company for the year 1908 shows that the production from the company's ores was 14,464,585 lb. This is the largest output in the history of the company. The cost of the production of electrolytic copper was figured out to be 10.96 cents a pound. This cost was figured after allowing for the silver and gold that were recovered. All except about 4,000,000 lb. of the company's copper was marketed as pig copper. The net profit for the year after making a deduction of $50,000 for depreciation was $254,768. At the annual meeting of the board of directors, Feb. 25, Mr. Frederick Lewisohn was elected president, succeeding Mr. J. Parke Channing, who resigned, and Mr. Sydney Riddlestorffer was chosen resident director in place of Mr. J. H. Susmann.

TO FORECLOSE ON HUDSON RIVER WATER POWER COMPANY.—The bondholders' committee of the Hudson River Water Power Company, of which Mr. F. J. Lisman is chairman, has decided to proceed at once with foreclosure proceedings against the company. The company was incorporated in 1899 to acquire the water power created by the fall of the Hudson between Palmer's Falls and Spier's Falls. It is controlled by the Hudson River Electric Power Company. The Hudson River Water Power Company has outstanding $5,000,000 stock and $1,938,000 of an authorized issue of $2,000,000 first mortgage sinking fund gold 5s, due 1929. Interest on these was defaulted on Nov. 1, 1908.

CHICAGO RAILWAY CONSOLIDATION ABANDONED.—The Chicago Railways Company has determined to stop all negotiations looking to a merger with the Chicago City Railway until the Railways company has completed the rehabilitation plans and demonstrated that its earning power is greater than the City Railway. Mr. H. A. Blair, chairman of the board of directors of the Chicago Railways Company, says that his company is ready to consolidate, to take over and operate or to buy outright the City Railway, but that the terms must be made reasonable. He declares that the recent valuation of the South Side lines is far too high and was made by the company's own appraisers.

PACIFIC TELEPHONE & TELEGRAPH COMPANY.—At the annual meeting of the Pacific Telephone & Telegraph Company, San Francisco, Mr. Henry T. Scott was elected president and Mr. E. C. Bradley vice-president and general manager. The surplus for the year 1908, after paying all charges and the dividend on the preferred stock, was $695,471. Mr. Bradley said that the company had increased its business at the rate of 1000 new telephones a month during 1908. The total number of instruments now in use is 47,000.

RIO DE JANEIRO COMPANY TO INCREASE STOCK.—The stockholders of the Rio de Janeiro Tramway, Light & Power Company will be called to a special meeting to authorize the directors to increase the capital stock by $6,250,000. The new stock will be offered to the present stockholders at the rate of one share of new to every four shares of old stock. It is said that the whole issue has been underwritten by a syndicate at par.

MUNICIPAL PLANT SHOWS GOOD EARNINGS.—The water and light commissioners of Duluth, Minn., report that the year 1908 shows that the water and gas plants were both good money earners. The net earnings of the former were $82,389 and of the latter $21,254. Considerable construction work was accomplished during the year.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Auburn & Syracuse Electric Railroad Company:					
Quarter ended Dec. 31, 1908	$91,293	$62,817	$28,476	$21,424	$2,851
Quarter ended Dec. 31, 1907	84,236	57,056	27,179	21,424	1,554
Aurora, Elgin & Chicago Railroad Company:					
December, 1908	109,578	62,553	47,025	27,996	19,029
December, 1907	109,506	62,297	47,298	28,034	19,265
Cataract Power & Conduit Company:					
Year 1908	1,058,531	743,000	315,531	108,574	209,899
Year 1907	975,254	639,914	335,339	100,084	1,538
Cumberland Telephone & Telegraph Company:					
January, 1909	533,858	305,125	228,732	44,747	183,985
January, 1908	519,731	286,079	233,651	38,876	194,775
Detroit United Railways Company:					
January, 1909	559,161	354,696	204,465	153,702	62,609
January, 1908	509,065	339,463	169,592	136,046	39,161
Ft. Wayne & Wabash Valley Traction Company:					
Year 1908	1,322,720	737,134	585,586	488,756	96,830
Year 1907	1,283,781	746,036	537,745	427,314	110,430
Georgia Railway & Electric Company:					
Year 1908	3,372,848	1,649,994	1,722,854	833,402	889,452
Year 1907	3,309,341	1,663,282	1,646,059	784,675	861,384
Illinois Traction Company:					
January, 1909	352,956	206,492	146,464	.....	.....
January, 1908	327,910	193,654	134,256	.....	.....
Kansas City Railway & Light Company:					
December, 1908	576,141	325,276	250,865	156,089	94,776
December, 1907	512,666	261,197	251,469	152,179	99,291
Lake Shore Electric Railway Company:					
December, 1908	67,092	39,790	27,302	29,106	*1,804
December, 1907	68,476	42,934	25,541	25,348	194
Milwaukee Electric Railway & Light Company:					
January, 1909	344,636	174,619	170,017	103,867	66,150
January, 1908	314,708	180,645	134,063	98,109	35,954
Memphis Street Railway Company:					
January, 1909	128,469	85,025	43,439	35,600	7,839
January, 1908	118,760	78,562	40,198	34,499	5,699
Montreal Street Railway Company:					
January, 1908	295,453	202,344	93,109	30,836	62,273
January, 1907	285,515	202,504	83,011	31,933	51,078
National Carbon Company:					
Year ended Jan. 31, 1909	.....	.....	980,283	315,000	665,283
Year ended Jan. 31, 1908	.....	.....	924,801	315,000	609,801
Niagara Falls and Canadian Niagara Power Companies:					
Year 1908	1,681,941	422,617	1,259,324	1,190,737	157,291
Year 1907	1,685,223	447,076	1,236,147	1,188,009	210,673
New Orleans Railway & Light Company:					
Year 1908	6,009,446	3,367,418	2,642,028	2,068,316	573,712
Year 1907	6,041,291	3,270,397	2,770,894	2,025,618	745,276
Norfolk & Portsmouth Traction Company:					
January, 1909	157,439	93,167	64,272	.....	.....
January, 1908	144,861	98,621	46,240	.....	.....
Northern Ohio Traction & Light Company, Akron, Ohio:					
January, 1908	147,895	84,710	63,185	43,952	19,233
January, 1907	126,125	81,892	44,233	43,887	346
Portland (Ore.) Railway, Light & Power Company:					
January, 1909	339,226	185,877	153,349	.....	.....
January, 1908	340,812	173,590	167,223	.....	.....
Rocky Mountain Bell Telephone Company:					
Year 1908	1,698,141	1,488,146	209,995	314,992	*104,997
Year 1907	1,561,797	1,516,255	45,542	.....	.....
Toledo Railway & Light Company:					
January, 1909	216,960	125,087	92,650	68,604	24,045
January, 1908	295,216	130,059	95,257	71,013	24,244
Toronto Railway Company:					
Year 1908	3,610,274	1,889,047	1,721,226	774,028	947,198
Year 1907	3,511,198	1,893,138	1,617,960	721,802	896,158
United Railways, St. Louis:					
Year 1908	10,593,166	6,737,460	3,855,706	3,647,898	207,808
Year 1907	10,828,737	7,043,882	3,784,855	3,427,183	357,672

*Deficit.

GENERAL NEWS

Construction News.

FAUNSDALE, ALA.—Plans and specifications are being prepared by Edward B. Kay, of Tuscaloosa, Ala., consulting engineer, for the construction of an electric light plant and water works system in this city.

NEW DECATUR, ALA.—The Cotton Growers' Industrial Company is planning to erect a new plant, which will be equipped for individual motor drive. It also proposes to install electric generating machinery to furnish electricity to operate the factory.

NEWTON, ALA.—The Choctawhatchee River Light & Power Company is planning to commence work on the construction of dams across the Choctawhatchee River near Newton and at Blackman's Mill, northwest of Newton, in the near future. About 4000 hp will be developed, which will be transmitted to Slocomb, Dothan and other towns in southeast Alabama. The Kelly Morris Lumber Company, of Slocomb, is interested in the enterprise.

OPELIKA, ALA.—The city is contemplating establishing a water and light system and invites correspondence on the subject. W. C. Robinson is city clerk.

PRATT CITY, ALA.—Arrangements are being made by the People's Home Telephone Company to install a larger switchboard and make other improvements.

SELMA, ALA.—Plans are being considered by John H. Bolinger, of this city, for the construction of an electric light plant.

BOONEVILLE, ARK.—The Booneville Light & Water Company contemplates the installation of a hydro-electric plant in connection with its proposed water-works system, bids for which will probably be received about April 1. The cost of work is estimated at from $100,000 to $150,000. John P. Thayer is president.

EUREKA SPRINGS, ARK.—We are informed that the Citizens' Electric Company contemplates the reconstruction of its tracks in Eureka Springs during the next three months and also an extension to its system of from three to six miles. A. M. Barron is general manager.

ALAMEDA, CAL.—Arrangements are being made by the Southern Pacific Railroad Company to change the motive power for operating its trains in Alameda from steam to electricity. The company will erect ornamental poles in the center of the streets traversed.

CHICO, CAL.—Application has been made to the City Trustees by Frank C. Wilson, representing the Sierra Electric Power Company, for a franchise to erect transmission lines in Chico for the distribution of electricity for lamps and motors.

CRESCENT CITY, CAL.—The Oro Del Norte Company has purchased the Dowdle mining property and proposes to install a plant for separating the metals from the sands, to be operated by electricity. Dr. T. R. Heintz is president of the company.

DELANO, CAL.—The Whitney Power Company has been granted a franchise by the Board of Supervisors to erect transmission lines for the distribution of electricity for lamps and motors in Delano.

GLENDALE, CAL.—The City Council has decided to call an election to vote on the proposition to issue $60,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

NEVADA CITY, CAL.—The Nevada County Gas & Electric Company is considering the question of abandoning its flat rate system and installing meters.

SACRAMENTO, CAL.—George P. Robinson, of Fair Oaks, Cal., is said to have secured an option on the property and holdings of the North Fork Ditch Company for six months, the price being fixed at $350,000. The company owns water rights on the American River in Placer County, near Auburn, and furnishes water for irrigation purposes to Fair Oaks and Orangevale, 30 miles distant. It is understood that Mr. Robinson is operating for Minnesota capitalists, who are planning to construct an electric railway between Sacramento and Lake Tahoe this year, and will utilize these water rights to generate electricity to operate the system.

SAN FRANCISCO, CAL.—The Tuolumne Water Power Company has filed a mortgage in favor of the Knickerbocker Trust Company, to secure an issue of $350,000 in bonds. The mortgage covers all the property of the water company, which is located along the Stanislaus River. H. H. Veeder is secretary of the company.

SONORA, CAL.—The Board of Supervisors has granted the Tuolumne Water Power Company permission to erect transmission lines on certain of the public highways until Jan. 1, 1911. The company has also applied for a franchise to erect transmission lines along certain highways of the county.

VALLEJO, CAL.—The Board of Trustees has granted the petition of the Randall, Wright & Trowbridge Company, of Oakland, for a franchise to operate a street railway system in Vallejo. The company agrees to furnish street lamps along the route of its railway.

NEW HAVEN, CONN.—The Ives Memorial Library Committee is considering the question of installing a gas making plant or an electric plant for lighting the building.

WASHINGTON, D. C.—Arrangements are being made to install a new system of street lighting on Massachusetts Avenue between Ninth and Fourteenth streets. It is proposed to erect posts in the middle of the street on which large arc lamps will be placed. If the plan proves successful the system will be extended to other wide streets.

PENSACOLA, FLA.—The East Pensacola City Company will soon commence work on the construction of its proposed electric railway from Pensacola to East Pensacola, about 1½ miles in length.

AUGUSTA, GA.—The War Department on Feb. 20 signed an order granting the Twin City Power Company permission to develop the water power at Price's Island, on the Savannah River, 26 miles above Augusta. It is proposed to develop 28,000 hp at a cost of about $3,000,000. The work will be done under the supervision of William H. Burr, of New York, N. Y., consulting engineer. The Ambursen Hydraulic Construction Company has the contract for the construction of the dam.

COVINGTON, GA.—The Central Power Company, which is constructing a large power plant on the Ocmulgee River, about 15 miles from Covington, has submitted a proposition to furnish electricity to operate the municipal electric plant and for private industries, and also to operate the local horse car system.

DOUGLASVILLE, GA.—The city will hold an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant or to grant a franchise to J. D. House, of Douglasville. It is proposed to install a plant at a cost of from $4,000 to $8,000.

ELBERTON, GA.—The citizens have voted to issue $5,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant.

VIDALIA, GA.—It is reported that the city will hold an election to vote on the proposition to issue $9,000 in bonds, the proceeds to be used for improvements to the electric light plant and water works system.

PAYETTE, IDAHO.—The City Council on Feb. 4 passed the ordinance granting a franchise to the Idaho-Oregon Light & Power Company over the Mayor's veto. The Mayor gave as his reasons for vetoing the ordinance that 15 cents per kw-hour was too high a price, and that the franchise does not provide for proper distance of pumping water to reservoir and to minimum charge of $1 per month.

POCATELLO, IDAHO.—The City Council has granted a franchise to the Independent Telephone Company to erect a telephone system in this city.

BOWEN, ILL.—The City Council has granted a franchise to James Bennett to install an electric light plant, work on which will begin early in the spring. The street lighting system will consist of 21 lamps to begin with, and many of the business places will be equipped with electric lamps.

CHICAGO, ILL.—The capital stock of the Appleton Electric Company has been increased from $10,000 to $50,000.

GEORGETOWN, ILL.—It is reported that the Georgetown Electric Company is planning to purchase the plant and property of the Ridgefarm Electric Light, Heat & Power Company. It is proposed to dismantle the plant and furnish electrical service in Ridgefarm from the Georgetown plant. The transmission lines of the local company already extend to Vermilion Grove.

NAUVOO, ILL.—The capital stock of the Nauvoo Electric Light & Power Company has been increased from $5,000 to $10,000.

STREATOR, ILL.—The City Council has granted the Illinois Light & Traction Company a 25-year extension to its franchise for operating its electric light and gas plant in Streator. The company will make extensive improvements to its system this year, which will involve an expenditure of about $40,000.

WINNETKA, ILL.—The North Shore Electric Company has submitted a proposition to the town officials offering to take over the municipal electric light plant for $70,000 and to furnish electricity for lamps at the rate of 13½ cents per kw-hour, with free lamp renewals. At a meeting held Feb. 21 the citizens voted not to sell the municipal plant, but voted instead to expend $40,000 for improvements and extensions to the system.

CRAWFORDSVILLE, IND.—The Home Telephone Company has agreed to accept a new franchise from the city which provides that five trustees, chosen from the business men of the city, shall represent the city and direct the management of the company. It provides that the present rate of $27 for business houses and $12 for residences be continued. A guarantee of 6 per cent as dividends is also provided by the company, and all in excess of 6 per cent will be divided one-half to the company and the balance will be rebated to the subscribers. The Home company has offered $40,000 to the Bell company for its local plant, including the switchboard. If the offer is not accepted, the Home company will build a new and larger switchboard.

EVANSVILLE, IND.—The Blue Grass Telephone Company has secured a franchise to construct a telephone line through Vanderburg and Warrick counties. John Tilze is president.

HAMMOND, IND.—The South Shore & Electric Company, of Hammond, Ind., has filed amendments to its charter with the Secretary of State, giving the company the privilege to construct, maintain and operate a gas lighting and heating system in the cities of Hammond, Whiting and East Chicago, Lake County, and vicinity. C. H. Geist is president, and C. W. Fox, secretary.

INDIANAPOLIS, IND.—The Legislature has appropriated $16,000 for the construction and equipment of a power and lighting plant at the Reform School for Girls. Mrs. E. L. Ealam is chairman board of trustees.

LIGONIER, IND.—Bids will be received by R. E. Jeanerat, city clerk, until March 25 for lighting the city for a term of five years.

MUNCIE, IND.—The Interstate Automobile Company, recently incorporated with a capitalization of $300,000, will establish and equip a large plant here for the manufacture of automobiles and accessories. The plant will be operated by electrical power. T. F. Hart, J. M. Haring, F. C. Ball and T. F. Rose are directors.

NORTH JUDSON, IND.—The Indiana & Illinois Navigation & Power Company, recently incorporated with a capital of $200,000, proposes to improve the Kankakee River from near South Bend to Momenee for the construction of hydraulic power plants and the generation of electricity.

PALMYRA, IND.—The Flat Woods Independent Telephone Company has filed articles of incorporation. The company proposes to build and operate a telephone system in Palmyra, Pekin, Bradford and other towns and communities. M. A. Smith, Lawrence Ellis, Joseph Uhl and Frank A. Fessel are directors.

SHOALS, IND.—The Shoals Telephone Company is in the market for material and equipment for a new exchange, including a new switchboard. The plant was recently destroyed by fire.

SOUTH BEND, IND.—Plans are being made by the Central Union Telephone Company to entirely rebuild its local plant at a cost of about $200,000. John L. Putnam is superintendent.

WARSAW, IND.—William Thorn and associates have organized a company to construct a dam and hydraulic plant in the Tippecanoe River at Monoquet. The company will construct a plant to generate electricity to be transmitted to Warsaw and other nearby towns.

CENTERVILLE, IA.—F. S. Payne, manager of the Centerville Light & Traction Company, has submitted a proposition to the Citizens' Committee of Payne, offering to construct an electric railway from Centerville to Payne if satisfactory arrangements can be made.

COUNCIL BLUFFS, IA.—The management of the Christian Home Orphanage is planning to make improvements and additions to the home, which will include the installation of a central steam heating and an electric light plant. Plans have been prepared for the plant, and estimates will soon be asked for. At present each building has a separate heating plant.

DES MOINES, IA.—An agreement has been reached between the Des Moines Electric Company and the City Council whereby a material reduction will be made in the charges for electricity for city service and a sliding scale for cheaper service for private consumers. Under the new arrangement all lamps will be placed on an all-night and every-night schedule at the rate of $65 per arc lamp per year, and incandescent lamps at $17 each per year. Under the old schedule the city paid $95 per arc lamp furnished by the underground system, and for all-night on the overhead system $75 per lamp per year, and for moonlight schedule $65 per year. The rate for incandescent lamps is reduced from $24 to $17 each per year. Rates for electricity for motors will be reduced from a flat rate of 7 cents to a maximum of 5 and 4 cents, and a minimum of 3 cents per kw-hour. The rate for commercial lighting, which was recently voluntarily reduced from 14 to 12 cents per kw-hour, was left unchanged. It is said that the company will take steps immediately to make extensive improvements to its system, which will involve an expenditure of $250,000.

ELDORA, IA.—The Eldora Electric Light Company contemplates installing two 1500-hp boilers in its plant.

GRUNDY CENTER, IA.—It is reported that the local electric plant has been sold. It is said that the new owners will remodel the plant and install new machinery.

MARSHALLTOWN, IA.—Plans are being considered to organize a company, with a capital stock of $200,000, to establish an electric plant in Marshalltown to secure cheaper rates for electricity for lamps and motors. D. T. Denmead is interested in the project.

CAWKER CITY, KAN.—Plans are being prepared for the construction of a municipal electric light plant and water works system in Cawker City.

CLAFLIN, KAN.—E. R. Burch has been granted a franchise to establish an electric light plant in Claflin.

PEABODY, KAN.—The Peabody Light & Power Company contemplates making extensions to its commercial circuits to supply electricity for both lamps and motors. Thomas Osborne is secretary.

HOPKINSVILLE, KY.—The City Light Company is considering the question of constructing a street railway system in Hopkinsville. E. K. Dewey is vice-president and general manager.

LOUISVILLE, KY.—P. Campbell, manager of the Fifth Avenue Hotel, contemplates applying to the City Council for a franchise to supply electricity for lamps in the hotel and also to the business houses in the immediate vicinity of the hotel.

RICHMOND, KY.—The board of regents of the Eastern Kentucky State Normal School has awarded contracts for the power plant for the school as follows: For construction of the power house, to the Combs Lumber Company, of Lexington, Ky., and for equipment, underground distributing system and heating apparatus, to F. A. Clegg & Company, of Louisville, Ky. The cost of the equipment will be about $32,000.

HOMER, LA.—The Town Board has awarded contracts for equipment of the proposed municipal electric light plant, as follows: To the Erie City Iron Works, of Erie, Pa.; Fort Wayne Electric Works, Fort Wayne, Ind., and the Wesco Supply Company, of St. Louis, Mo. Anderson Offut, of New Orleans, La., will have charge of construction of the plant.

ANDOVER, MAINE.—A bill has been presented to the State Legislature for the incorporation of the Andover Water Company with a capital stock of $50,000. The company contemplates constructing a water works system and proposes to install an electric light plant to furnish electricity to light the town. The power plant will be located about three miles from the town. The officers are: Frank P. Thomas, president; Y. A. Thurston, vice-president, and J. A. French, treasurer.

AUGUSTA, MAINE.—A bill has been introduced in the Legislature authorizing the Merrill Springer Company to generate, distribute and sell gas and electricity for light, heat and manufacturing purposes.

BIDDEFORD, MAINE.—The Pepperell Manufacturing Company has awarded contract for 125 motors, aggregating about 1000 hp, to be installed in the Pepperell plant of the company.

EASTPORT, MAINE.—The City Council has granted a franchise to E. B. Nichols to construct and operate an electric light plant in Eastport. The plant is to cost about $10,000.

KENNEBUNK, MAINE.—The citizens are considering the question of installing an auxiliary steam plant in the municipal electric light plant. A committee, consisting of A. J. Wiggin, Joseph Sayward, E. I. Littlefield, C. W. Andrews and Frank Parsons, has been appointed to look into the matter. Owing to the lack of water power during the past year, it has been necessary to cut out much of the street lighting service in order to furnish electricity for commercial lighting.

LITCHFIELD, MAINE.—A bill has been introduced to the Legislature to incorporate the Litchfield Electrical Company, which proposes to supply electricity in Litchfield. The capital stock of the company is placed at $10,000. O. Smith, I. W. Gilbert, J. E. Chase, G. M. Rogers and others are interested in the project.

LITCHFIELD, MAINE.—The main thoroughfare in the business section of the town is now lighted by electricity from the electric plant of Frank N. Adams. The plant is operated by water power and furnishes electricity for lighting the store, grist mill and Union Hall. The street lamps are furnished to the town free of charge.

RICHMOND, MAINE.—A bill has been introduced in the Legislature by Representative Allen, of Richmond, authorizing the Richmond Electric Company to supply electricity for lamps, motors and other purposes in the towns of Richmond and Bowdoinham.

SCARBORO, MAINE.—A bill has been introduced to the State Legislature to incorporate the Scarboro & Cape Elizabeth Railway Company, which proposes to operate an electric railway beginning at South Portland Heights, through South Portland, Cape Elizabeth, Scarboro and Westbrook. The capital stock is not to exceed $400,000. Samuel D. Plummer, of Portland; William F. Spear, of South Portland; Harry S. Jordan, of Cape Elizabeth; John A. Snow, of Scarboro, and others are interested in the project.

BALTIMORE, MD.—Arrangements are being made by the West Baltimore Business Men's Association to install 120 arc lamps on Baltimore Street, between Paca Street and Fulton Avenue. Already $2,500 has been subscribed, and as soon as $5,000 is raised Superintendent of Lamps and Lighting McCuen will install the lamps. The present plans provide that the merchants shall pay for electricity for 80 of the additional lamps and the city for the other 40 lamps.

CAMBRIDGE, MASS.—The State Board of Gas and Electric Light Commissioners has approved of an issue of $20,000 additional capital stock of the Cambridge Electric Light Company, the proceeds to be used to cancel outstanding indebtedness of the company.

GLOUCESTER, MASS.—The Massachusetts State Gas and Electric Light Commissioners have granted the Gloucester Electric Light Company permission to issue 600 additional shares of stock at $110 per share, the proceeds to be used to pay its floating indebtedness and for additions to its plant.

LAWRENCE, MASS.—Preliminary plans have been prepared for the construction of the proposed Ayer Mill by the American Woolen Company. The plans call for a building 621 x 125 ft., six stories high, with a dye house and also an electric power station with an output of about 4000 kw. Charles T. Main, of Boston, is engineer.

NORTH ABINGTON, MASS.—The Electric Light & Power Company of Abington and Rockland has applied to the Selectmen of Hanover for permission to erect transmission lines over certain streets in that town for the purpose of extending its high-tension line to Clapp's Rubber Mill to furnish electricity for motors.

NORTH ADAMS, MASS.—Plans are being made to enlarge the Greylock Cotton Mills, which will double the output of the mills. A new power plant will be installed to operate the entire plant, replacing the present steam plant.

STONEHAM, MASS.—The Boston & Northern Street Railway Company has been granted a franchise by the Selectmen of Stoneham, allowing it to complete the electric railway through Middlesex Fells and around Spot Pond. The railway is to be built jointly by the Boston Elevated and the Boston & Northern companies.

DETROIT, MICH.—The Detroit United Railway Company has presented plans to the sub-committee of the Council for extensions to its system, which provides for the construction of 50 miles of new track.

GRAND RAPIDS, MICH.—Bids will be received by the Board of Public Works until March 11 for furnishing transformers and switches for the sewage pumping station machinery. Samuel A. Freshney is secretary of Board of Public Works.

GRAND RAPIDS, MICH.—Plans are being made by the Grand Rapids Electric Railway Company for the construction of the southeastern division of its proposed electric railway, contracts for which will be awarded in the near future. This section of the railway will extend from Kalamazoo to Battle Creek, Burlington, Coldwater and Camden, across the state line and into Ohio. Another part of the system will be built from Grand Rapids to Greenville, Edmore and Mount Pleasant. We are advised that work on construction of both of these branches will begin early this spring. C. J. Post is secretary of the company.

LUZERNE, MICH.—The Board of Supervisors of Oscoda County has granted the Eastern Michigan Power Company a franchise to construct dams on the Au Sable River in Oscoda County.

TECUMSEH, MICH.—The Tecumseh Electric Company has submitted a proposition to the City Council asking to have its present contract for street lighting, which expires next May, annulled and a new one entered into at once for a term of five years. As an inducement the company offers to make the rate for electricity for residential lighting 11 cents per kw-hour up to 50 kw-hours a month, and 5 cents per kw-hour for all consumed above that amount, with a discount of 10 per cent for all bills paid before a certain date each month.

FRAZEE, MINN.—Plans are being made to install another telephone system in Frazee, at a cost of about $5,000. E. F. Gummer, and B. Y. McNairy are the promoters of the project.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company has notified the officials of the Linden Hills district that the board of directors has approved the requisition covering the cost of extending its transmission lines to Linden Hills and to the south shore of Lake Harriet, and that work would begin on the extension as soon as the frost is out of the ground. The citizens of Linden Hills section have taken steps to organize a company to be known as the Lake Harriet Electric Company, to establish a local plant. Truman Hibbard is general manager.

ST. CLOUD, MINN.—The Granite City Railway Company is planning to construct 3½ miles of track during the coming season.

THIEF RIVER FALLS, MINN.—Bids will be received by L. Bache, city clerk, until March 15 for the construction of a local telephone plant of from 300 to 500 telephones.

CALIFORNIA, MO.—The citizens have voted to grant an electric light franchise to S. W. Carver, of Neosho, who proposes to purchase the local electric light plant. It is said that he will remodel the plant.

KANSAS CITY, MO.—Plans have been submitted to the Board of Public Works by H. C. Fowler, president of the Fidelity Trust Company, for an ornamental system of electric lamps around the Fidelity Building. The company proposes to erect and maintain the lamps at its own expense. The cost of eight posts and equipment is estimated at about $1,500.

ST. JOSEPH, MO.—The Citizens' Telephone Company has been reorganized under the name of the Home Telephone Company, with a capital stock of $2,000,000. Theodore Gary, of Macon, is president, and Homer E. Scovern, secretary.

GREAT FALLS, MONT.—The citizens have voted to grant a franchise to G. Calvin Bower and associates to construct a street railway on certain streets in Great Falls in connection with their proposed electric railway between Great Falls and Choteau.

HARTINGTON, NEB.—Application has been made to the town officials by Mark Hurlburt for a franchise to install and operate an electric light system in Hartington.

SCOTT'S BLUFF, NEB.—A franchise has been granted by the Town Council to Clarence J. Morley, of Denver, Col., and James C. Caine, of Salida, Col., to construct and operate an electric light plant. Under the terms of the franchise the plant is to be in operation within five months. The company will furnish electricity to operate the pumping station of the municipal water system. The franchise is for a term of 25 years, and the city has the privilege of buying the plant at five-year intervals during the life of the franchise.

WYMORE, NEB.—The light committee, recently appointed by the City Council to investigate the question of installing a municipal electric light plant, has reported in favor of establishing the plant. The Council has instructed the committee to prepare resolutions for the purpose of submitting the question of issuing $10,000 in bonds for the construction of the plant at the spring election.

MILFORD, N. H.—Extensive improvements are being made to the plant of the Milford Light & Power Company, involving an expenditure of about $60,000. The Milford Light & Power Company has submitted a proposition to the town offering to furnish electricity to operate the pumping station for a term of 10 years. The company offers to furnish the service for $1,200 per year, and all water pumped in excess of 35,200,000 gal. in one year is to be paid for at the rate of 3 cents for each 1000 gal. The town also to pay $150 to furnish a man to remain at the pumping station between midnight and 6 o'clock. The company also offers a new proposition for street lighting based on at least five arc lamps of 1200 cp at $100 each per year and 115 25-cp incandescent lamps at $17.50 each per year.

TILTON, N. H.—Part of the first floor of the old Peabody Mills, owned by the Tilton Mills, is being remodeled into an electrical power plant, which will be used as an auxiliary plant for the Tilton Electric Company.

BELLEVILLE, N. J.—The township committee has entered into a contract with the Public Service Corporation of New Jersey to light the streets of the town for a term of five years. Under the terms of the contract the town is to pay $12 per lamp for the first year and $15 each per year thereafter. The contract has been pending for several months.

CLOVIS, N. M.—The citizens on Feb. 23 voted to issue $125,000 in bonds, the proceeds to be used for the construction of an electric light plant, water works and sewerage systems, work on construction of which will begin at once. A. Wade, of Clovis, is engineer.

BATAVIA, N. Y.—The question of installing an additional generating unit, with a rating of 75 kw, in the municipal electric light plant is under consideration by the Board of Aldermen, for which specifications will be prepared and bids called for in the spring.

BERGEN, N. Y.—Contracts have been awarded by the Village Board for equipment of the municipal electric light plant as follows: For engine generator and two 75-hp boilers, to the Ridgeway Dynamo & Engine Company, of Ridgeway, Pa., for $4,200, and for line supplies, to the Rochester Electric Motor Company, for $1,021.

ELLIS ISLAND, N. Y.—Sealed proposals will be received at the office of the Commissioner of Immigration, Ellis Harbor, N. Y. H., until March 11 for furnishing and installing electric fixtures in the new hospital extension No. 2 Island, at U. S. Immigrant Station, Ellis Island. Further information may be obtained from Robert Watchorn, commissioner.

FULTON, N. Y.—It is said that plans are being considered whereby the Fulton Light, Heat & Power Company and the manufacturing interests at the lower dam, consisting of the Volney Paper Company, Victoria Paper Company, Gramley Paper Company, Delts Machine Works and the Hunter Arms Company, may consolidate and utilize the water power at the lower dam. It is proposed to use the entire water power by one central electric power station, which will furnish electricity to operate all the plants.

LONG ISLAND CITY, N. Y.—The Long Island Railroad Company is making preparations for the rebuilding of its North Shore division. The road will be double tracked and the motive power will be changed from steam to electricity, operated by the third-rail system. The cost of the work is estimated at about $3,000,000. The railway extends from Long Island City through Flushing, College Point, Malba and Whitestone to the terminus at Port Washington.

NEWBURGH, N. Y.—G. L. Wittman has been appointed by the Merchants' Association to make investigations as to the cost of the installation of a municipal electric light plant.

NEW YORK, N. Y.—Plans have been filed for the erection of a power house at Rikers Island for the City of New York, to cost $80,000. Trowbridge & Livingston, 527 Fifth Avenue, New York, N. Y., are the architects.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 27 for furnishing and installing condensing equipment and piping for one 1000-kw alternator at the navy yard. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 9 to furnish at the Navy Yard, New York, N. Y., the following supplies: Schedule 950, generator sets; Schedule 951, motors; Schedule 951, lamp sockets and rubber; Schedule 962, brass, bronze and steel tubing and steel. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished on application to the Navy Pay Office, New York, N. Y., or to the above bureau.

ROOSEVELT, N. Y.—The Roosevelt Water, Light & Power Company, which was recently granted a franchise by the Town Board to furnish the village and surrounding territory with water, has purchased a site in the Whitehouse villa section of Roosevelt, on which it will erect its pumping station, etc. The company proposes to commence work on the construction of the plant early in the spring.

SCHENECTADY, N. Y.—The Board of Supervisors has awarded a contract to the General Electric Company for the installation of 400 tungsten lamps in the State Armory to replace the incandescent lamps now in use.

BRYSON CITY, N. C.—The Franklin Manufacturing & Development Company, recently incorporated, proposes to do a general timber business and supply electricity for lamps.

CHARLOTTE, N. C.—Bids will be received until March 15 for lighting the streets and other public places of the City of Charlotte with electricity for a term of five years from Aug. 15, 1909. The contract will include not less than 250 arc lamps and possibly 325 or more; the lamps to be of the latest arc type, of not less than 6.6 amp and 70 volts at the lamps. The successful bidder must erect complete and maintain the lamps with an all-night and every-night service. For further information address A. H. Washburn, chairman of light committee.

HICKORY, N. C.—The Water-Power Electric Company, of this city, Col. M. E. Thornton, president, has perfected arrangements to take over the water power at Horseford Shoals. It is estimated that 10,000 hp will be developed.

KINSTON, N. C.—The Town Council has taken preliminary steps looking to the holding of an election to vote on the proposition to issue $75,000 in bonds, the proceeds of which to be used for building a municipal telephone system and for increasing the city's water, lighting and sewerage plants, etc.

MARION, N. C.—The Marion Light & Power Company is building a storage dam by which the efficiency of the plant will be largely increased.

MONROE, N. C.—The Southern Power Company has secured a site and will begin immediately the erection of a substation for the distribution of electricity in the town. Several large manufacturing plants, it is understood, will secure electric service from the company.

MANDAN, N. D.—Plans are being made by the Mandan Electric Company to enlarge its plant, which will include the installation of two new boilers.

ADRIAN, OHIO.—Plans are being prepared by the Independent Telephone Company to install an automatic telephone plant in Adrian, to cost about $150,000.

AKRON, OHIO.—All the telephone and telegraph companies operating in the city have submitted plans for putting their wires in the downtown district under ground. The Northern Ohio Traction Company will also be required to place its wires in conduits in that portion of the city.

BUCYRUS, OHIO.—The City Council has granted a franchise to F. C. Kingsbury, of Columbus, Ohio, to construct and operate an electric light plant and also a contract for street lighting. Under the terms of the contract Mr. Kingsbury is to furnish arc lamps on an all-night schedule at the rate of $74.50 per lamp per year and on a moonlight schedule at $69 each per year. The new plant is to be completed and in operation within eight months. Through error, this information was published under Cleveland, Ohio, in the issue of Feb. 25. The city had voted to construct a municipal electric plant and had been enjoined from issuing the bonds.

DAYTON, OHIO.—The Home Telephone Company contemplates extending its system and establishing a number of branch exchanges within the next year, at a cost of from $100,000 to $150,000. R. D. Funkhouser is secretary and treasurer.

POWELSVILLE, OHIO.—The Pine Creek Telephone Company has consolidated with the Haverhill Telephone Company. A new telephone line will be erected from the Junior bridge on Pine Creek to Empire Furnace. Jacob Apel, Charles Edwards, John Dearford and others are interested in the company.

WOODSFIELD, OHIO.—The plant and holdings of the Woodsfield Telephone Company have been taken over by the National Telephone Company of Wheeling, W. Va., with several other lines in the county. It is said that the new owners will make improvements to the system, work on which will begin at once.

XENIA, OHIO.—The Board of Public Service has awarded the contract for street lighting to the Citizens' Electric Light & Power Company.

GRANTS PASS, ORE.—The City Council has granted a franchise to the Citizens' Telephone Company to operate a telephone system in Grants Pass. The company promises to install the central energy system.

NEWPORT, ORE.—The City Council is considering the question of granting a franchise for the construction of an electric light plant in Newport. Under the amended franchise the city is to lease a portion of the water front on which to construct a plant and to grant a franchise to operate an electric light plant, cold storage plant and creamery for a term of 25 years. At the expiration of 25 years the city has the option of buying the plant or releasing it. Electricity is to be furnished the city for street lamps at the rate of $1.60 per month per lamp and for pumping the water supply within the city limits. Mr. Sanderson is promoting the project.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has applied to the Council of Fairview for a 30-year franchise for its branch to run through Fairview.

AVONDALE, PA.—The Chester County Electric Company is making plans to erect a large power plant in Avondale. The company furnishes electricity in many towns in the southern part of Chester County.

BEDFORD, PA.—The City Council has granted the Altoona, Hollidaysburg & Bedford Springs Railway Company a franchise to construct and operate a street railway over certain streets in Bedford. The company proposes to construct an electric railway connecting the three named cities in its title. The railway from Altoona to Roaring Springs, about 18 miles in length, is under construction.

BLOOMSBURG, PA.—The Columbia Power, Light & Railways Company is planning to construct a 25-mile 23,000-volt 3-phase transmission line, with transformers, etc., and also to install a 500-hp water turbine, a 300-kw rotary converter and a 200-kw railway generator (belted), with switchboards, etc., in its power house. B. O. Ellis is general manager.

CORY, PA.—The Cory & Columbus Street Railway Company is in the market for a generator and gas engine.

ILOILO, P. I.—The Iloilo Electric Company contemplates the installation of a new boiler and a 200-kw generator in its power house. R. R. Landen is manager.

ANDERSON, S. C.—The Anderson Traction Company is considering the question of extending its interurban railway from Belton toward Greenville and to Greenwood.

SENECA, S. C.—The report published in last week's issue that A. B. Groscoe, of Spartanburg, had purchased the water power on Change Creek was incorrect. It is said that the property is owned by the Traxler-Taylor Real Estate Company, of Greenville, S. C.

SPARTANBURG, S. C.—A proposition for supplying electricity for lighting the city has been submitted to the Town Council by the Southern Power Company, of Charlotte, N. C.

YANKTON, S. D.—The Yankton Telephone Company has awarded a contract to the Dean Electric Company of Elyria, Ohio, for the installation of a common battery multiple switchboard with a capacity of 6,400 lines. The company contemplates other improvements, which involve a total expenditure of about $25,000 this year.

BINGHAMTON, TENN.—Work has commenced on the construction of the new electric light plant of the Binghamton Electric Power Company. J. A. Omberg, Jr., S. M. Neely, W. M. Boyle and F. W. Faxon are interested in the project. The company is capitalized at $25,000.

GREENVILLE, TENN.—An election will be held March 20 to vote on the proposition to issue $25,000 in bonds for construction of a water works system and $15,000 in bonds to establish an electric light plant. J. J. Mitchell is mayor.

MARYSVILLE, TENN.—The stock of the Rockford Electric Company has been taken over by Benjamin Cunningham, Joseph Burger, James L. Clark and Ernest Koella. It is said that the new company will commence work at once on the reconstruction of the power plant at Rockford.

MOUNT PLEASANT, TENN.—Plans are being considered by the City Council for the construction of water-works system, electric light plant and sewerage system. The cost of the work is estimated at from $75,000 to $100,000. J. G. Jackson and F. De Marco, of Mount Pleasant, Tenn., are engineers.

SPRING HILL, TENN.—It is reported that Cheek, Andrews & Jones, owners of the Spring Hill Mills, are considering the installation of an electric light plant.

WHITEVILLE, TENN.—It is reported that Edward Stewart and Rivers Norment are contemplating the construction of an electric light plant at a cost of about $5,000.

CROWELL, TEX.—The City Council has granted a franchise to L. G. Andrews and W. L. Campbell to construct and operate an electric light plant in Crowell.

FT. SAM HOUSTON, TEX.—Bids will be received until March 25 by L. J. Fleming, constructing quartermaster, U. S. Army, for installing in the post hospital an electric invalid's elevator with grill enclosures and gate complete and for electric connections to street car lines.

HOUSTON, TEX.—The City Council of Houston Heights has granted a 30-year franchise to the Houston Electric Company to extend its street railway system in that city.

SNYDER, TEX.—R. F. Brumbach, of Ennis, Tex., has been granted a franchise by the City Council to install an electric light plant.

TEMPLE, TEX.—The City Council has granted a franchise to Max Ellser and associates, of New York, N. Y., to construct an electric railway in Temple. The city of Waco recently granted the above parties a similar franchise. It is proposed to construct an interurban railway connecting Temple and Waco.

TERRELL, TEX.—The contract for the equipment of the municipal electric light plant has been awarded to Houston & Cunningham, of New Orleans, La., for $14,783. W. C. Drake is engineer in charge.

WHARTON, TEX.—The City Council has granted a franchise to J. J. Wensley, manager of the Wharton Ice & Cold Storage Company, to erect and operate an electric light plant.

SALT LAKE CITY, UTAH.—Plans are being made by the Utah Light & Railway Company for extensive improvements and additions to its system. The company will soon install an additional 3000-hp motor-generator set at a cost of $35,000, and also proposes to erect an emergency plant on Jordan River, with a steam generating plant, the cost of which is estimated at $500,000.

BRATTLEBORO, VT.—The Twin State Gas & Electric Company will soon commence work on the reconstruction of its pole line extending from Brattleboro to Hinsdale, N. H. High-tension transmission wires will be erected on the new poles.

LUDLOW, VT.—Owing to the increase in demand for electrical service, the managers of the municipal electric light plant are considering the question of increasing the output of the plant, or making arrangements to secure electricity from the plant at Cavendish Gorge.

FREDERICKSBURG, VA.—The City Council has adopted an ordinance to receive bids for a franchise to furnish electricity for lamps and motors and other purposes. The Fredericksburg Power Company has applied for such franchise in Fredericksburg.

NORFOLK, VA.—We are informed that the Norfolk & Portsmouth Traction Company will rebuild its Suffolk power station, which was burned Feb. 24. The power house will be equipped with machinery taken from stations which have been dismantled. E. C. Hathaway is general manager.

RICHMOND, VA.—The committee on electricity has accepted the plans of E. W. Trafford for the new electric light and power plant and recommended their adoption by the City Council. The plans have been approved by Pressy & Weller, of Washington, D. C., consulting engineers, who were selected by the Council to investigate the plans and specifications.

SUFFOLK, VA.—The plant of the Suffolk Light & Ice Company was destroyed by fire Feb. 24, causing a loss of about $10,000. Most of the equipment of the electric plant was saved. The plant was owned by the Norfolk & Portsmouth Traction Company and will be rebuilt at once.

ENDICOTT, WASH.—Preliminary steps have been taken by the local Farmers' Union in Endicott for the construction of a flour mill. It is proposed to operate the mill by electricity, to be furnished by a plant located on the Palouse River, seven miles from this town. It is also planned to furnish electricity for lighting the town.

KETTLE FALLS, WASH.—It is reported that A. H. Sperry, of Spokane, Wash., president of the Northwestern Light & Power Company, is negotiating with the owners of the water power at Meyers Falls, on Colville River, for all the power that can be obtained. It is said that the additional power will be utilized to operate an electric railway down the banks of the Columbia River to Fort Spokane.

WASHTUCNA, WASH.—It is reported that Messrs. Codd and McKenzie, of Colfax, Wash., are contemplating the construction of a power plant at the Palouse River, at the "great falls" of the Washtucna.

PENNSBORO, W. VA.—Application has been made to the City Council by O. E. Pratt for a franchise to construct and operate an electric light and power plant in Pennsboro.

CUMBERLAND, WIS.—The McKinley Telephone Company has decided to install a telephone exchange in this city and connect with the rural telephone lines in this county.

ELKHART, WIS.—The Eastern Wisconsin Telephone Company has filed amendments to its charter increasing its capital stock from $15,000 to $25,000.

LITTLE RAPIDS, WIS.—Arrangements are being made to erect a large steel and concrete pulp mill at Little Rapids, near De Pere, Wis., and to develop a water-power of about 2500 hp to operate the plant. Luther Lindauer, of Kaukauna, Wis., is interested in the project.

LYONS, WIS.—Plans are being made to organize a local telephone company to establish a telephone system, which will cover the Town of Lyons and part of the towns of Spring Prairie, Bloomfield and Geneva, and connect with the Wisconsin Telephone Company's exchanges at Burlington, Lake Geneva and Elkhorn.

MENASHA, WIS.—The Walter Brothers Brewing Company has awarded a contract to the Western Electric Company for the installation of a 150-hp Chuse engine and an 85-kw generator.

MENOMONIE, WIS.—Plans are being made to organize a farmers' telephone company to unite a circuit to connect between 100 and 200 farmers in Dunn, Eau Claire and Pepin counties. The central office will probably be located in Rock Falls.

MILWAUKEE, WIS.—Thomas J. Neacy has been granted a temporary injunction restraining the city from proceeding with the erection of the proposed municipal electric light plant.

MILWAUKEE, WIS.—The H. W. Johns-Manville Company is preparing to rebuild its plant, which was recently destroyed by fire. The plans call for power equipment of about 750 hp, all machines to be operated by motors. The plant will be equipped with special machinery of the company's own design for the special work done in that factory. The headquarters of the company are in New York, N. Y.

STURGEON BAY, WIS.—It is reported that plans are being made for extensive improvements to the municipal electric light plant, which will involve an expenditure of about $30,000. H. C. Leonhardt is city clerk.

WAUKESHA, WIS.—The capital stock of the Prospect, Guthrie & Big Bend Telephone Company has been increased from $3,000 to $10,000.

WAUSAU, WIS.—The capital stock of the Wausau Telephone Company has been increased from $20,000 to $80,000, of which the proceeds of $40,000 will be used for improvements and extensions to its system, the remaining $20,000 to be held in the treasury.

SHOSHONI, WYO.—The large dam of the Big Horn Power Company on the Big Horn River will be completed in about 60 days, when work on the installation of machinery and erection of transmission lines will commence. About 6000 hp will be developed. The plant will furnish electricity to operate the mines of the Boysen Mining Company, about 12 miles from Shoshoni, and to towns within a radius of 100 miles.

CLARESHOLM, ALTA., CAN.—Orr Jarvis, of Winnipeg, Man., has been asked by the Town Council to submit a tender for an electric light and power franchise in Claresholm.

MEDICINE HAT, ALTA., CAN.—The Southern Alberta Electric Railroad Company has secured a charter and will build an electric railway in this town and through the adjoining districts. For further information address A. M. Grace, Medicine Hat, Alta.

VICTORIA, B. C., CAN.—A bill will be introduced at the Provincial Legislature providing for government ownership of all telephones in British Columbia. The British Columbia Telephone Company has a virtual monopoly along the Pacific coast, but in the interior various local companies are operating.

PORTAGE LA PRAIRIE, MAN., CAN.—A local syndicate, represented by E. A. McPherson, attorney, is applying for a franchise here to distribute electricity for lamps and motors, and also to build an electric car system. It is stated the company is subsidiary of the Winnipeg Electric Company, of Winnipeg, Man.

WINNIPEG, MAN., CAN.—The Canadian Northern Railway Company has decided to equip its shops in Winnipeg to be operated by electricity. For further information address M. H. McLeod, general manager.

WINNIPEG, MAN., CAN.—The City Council has decided to purchase a transformer to be used in testing insulators, to cost about $10,000, for which tenders will be called. For further information address F. E. Cambridge, city electrician.

GRAND FALLS, N. B.—The contract for the construction work in connection with the hydro-electric development of the Grand Falls Power Company on St. John River at Grand Falls has been awarded to Frank B. Gilbreth, of New York, N. Y. The plant will have an output of 100,000 hp, which will be transmitted to various cities in New Brunswick and Maine. The cost of the plant is estimated at $5,000,000, work on which will begin immediately. John B. McRae, of Ottawa, Ont., is chief engineer, and Ralph Mershon, of New York, N. Y., is electrical engineer.

ST. JOHN, N. B.—A company has been organized for the purpose of harnessing the tides of the Bay of Fundy, to be utilized for mechanical purposes. The company has petitioned the Dominion Parliament for permission to incorporate.

BURLINGTON, ONT., CAN.—Bids will be received by O. T. Springer, village clerk, until March 23 for the construction of the proposed waterworks system, including electrically operated pumping machinery. Willis Chipman, 103 Bay Street, Toronto, Ont., is chief engineer.

CORNWALL, ONT., CAN.—The Long Sault Development Company is applying to the Dominion government with altered plans to develop electrical power on the St. Lawrence River in Cornwall. The plans call for the construction of a large dam.

PORT ARTHUR, ONT., CAN.—The City Council has decided to abolish the telephone and electric light commission and look after the two municipal industries from the Council chamber.

ST. THOMAS, ONT., CAN.—A number of the telephone companies operating in the southern counties have organized an independent association and will petition the Ontario government for government-owned long-distance lines and control of rates.

TILBURY, ONT., CAN.—The Tilbury Telephone Company has been granted a 20-year franchise to use the city streets on condition that charges for telephones do not exceed $12 per annum.

TORONTO, ONT., CAN.—The Hydro-Electric Power Commission has awarded contracts for equipment of the different distributing and transforming stations in connection with the Provincial Niagara scheme, which will call for an expenditure of $750,000. The Canadian General Electric Company secured the contract for two-thirds of the work, and the Canadian Westinghouse Company, of Hamilton, Ont., one-third. The contracts awarded will include the equipment for 12 stations, the chief of which will be the stepping-up station at Niagara Falls and Dundas, which will be the interswitching station for the entire system. The other stations will be located at Toronto, supplying West Toronto, Milton, Acton, Brampton, Weston and Mimico; Guelph; Preston, supplying Galt and Hespeler; Berlin, supplying Waterloo, Elmira and New Hamburg; Stratford, St. Mary's; London, supplying Port Stanley; Woodstock, supplying Ingersoll, Tilsonburg and Norwich, and Brantford, supplying Paris, St. George and Ayr.

LEVIS, QUE., CAN.—The Levis County Railway Company is installing a 250-kw Allis-Chalmers Bullock motor generator set in its substation. The company purchases electrical energy from the Canadian Electric Light Company, which is transmitted to the substation on a 11,000-volt 3-phase high-tension line.

MONTREAL, QUE., CAN.—The Montreal Street Railway Company is applying to the Dominion Parliament for the necessary power to construct and operate an elevated street railway in this city.

SHERBROOKE, QUE., CAN.—The stockholders of the People's Telephone Company have voted to issue $50,000 in bonds, the proceeds to be used for extensions and improvements to the plant.

REGINA, SASK., CAN.—Representatives of the Bell Telephone Company and the Saskatchewan government are conferring with a view to the government purchasing the Bell system in this province.

WIDEAWAKE, SASK., CAN.—A telephone company, which will have long-distance lines running to Weyburn, Yellow Grass, Milestone and other adjacent towns, is being organized by farmers in this vicinity.

Company Elections.

LOS ANGELES, CAL.—The stockholders of the United States Electrical Manufacturing Company have elected the following directors: C. L. Limback, Edgar Sharp, Carl E. Johnson, H. Stewart and W. W. Piddington. The directors have elected the following-named officers: W. W.

Piddington, president; Edgar Sharp, secretary, and Carl E. Johnson, superintendent.

ATLANTA, GA.—At the annual meeting of the Southern Bell Telephone Company the following-named officers were elected: W. T. Gentry, of Atlanta, Ga., president; J. M. B. Hoxsey and J. Epps Brown, vice-presidents; D. J. Carson, secretary and treasurer; A. E. Holcomb, of New York, N. Y., assistant secretary.

CANANDAIGUA, N. Y.—At the annual election of the Ontario Light & Traction Company the following-named directors were elected: Horace E. Andrews, William K. Vanderbilt, Jr., Edward V. W. Rossiter, John Carstensen and Walter N. Kernan.

PATCHOGUE, N. Y.—At the annual meeting of the Patchogue Electric Light Company the following officers were elected: E. E. Hawkins, Jr., president; J. T. Losee, vice-president; H. S. Conklin, secretary and treasurer. The company recently increased its capital stock and is planning to extend its service to surrounding territory.

MEMPHIS, TENN.—At the annual meeting of the Memphis Street Railway Company E. E. Wright was elected vice-president to succeed John H. Watkins. James E. Beasley was elected to succeed Joseph H. Thompson as a member of the board of directors.

HAVANA, CUBA.—At the annual meeting of the Havana Electric Railway Company the retiring board of directors was re-elected.

New Industrial Companies.

THE INTERSTATE CONSTRUCTION COMPANY, of Greensboro, N. C., has been organized, with a capital stock of $50,000, to engage in all kinds of construction and contracting work by Ernest Clapp and others.

THE RECIPROCATING ELECTRIC MOTOR COMPANY, of Charleston, W. Va., has been incorporated with a capital stock of $500,000 to manufacture electric motors, by Eli T. Conner, H. McKean Conners and others.

THE OHIO ELECTRIC CARRIAGE COMPANY, of Toledo, Ohio, has been chartered with a capital stock of $200,000 by H. P. Dodge, R. R. Lee, James Brown Bell, E. W. Baumgardner, F. H. Dodge and others. H. P. Dodge will be general manager.

THE MOTOR SERVICE COMPANY, of Wilmington, Del., has filed articles of incorporation with the Secretary of State with a capital stock of $300,000. The incorporators are: F. M. Shive, S. E. Roberson and Harry W. Davis, of Wilmington, Del.

THE EMPIRE TRACK BRAKE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture engines, boilers, dynamos and pumps, by G. Q. Dean, Fred. Knowlton and P. K. Stauff, all of New York, N. Y.

THE ELECTRIC SHOP, of Chicago, Ill., has filed articles of incorporation with a capital stock of $1,000 to carry on a general electrical and mercantile business. The incorporators are: Harry J. Dunbaugh, J. Edwin Wing and George C. Madison.

THE SHAW DRY GAS CARBURATOR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000 to manufacture gas engines by Robert W. Shaw, of Stamford, Conn.; Gavin Rue and Henry Silverman, both of New York, N. Y.

THE HUNTINGTON-BARGAR MACHINE COMPANY, of Jamestown, N. Y., has been chartered with a capital stock of $5,000 to manufacture engines and machinery by William Huntington, Lewis T. Bargar and J. Delevan Curtiss, all of Jamestown, N. Y.

THE LOCKE MANUFACTURING COMPANY, of Robinson, Ill., has filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing boilers and engines. The incorporators are: H. W. Locke, A. P. Woodworth and W. E. Fritz.

THE GEISZLER BROTHERS STORAGE BATTERY COMPANY, of New York, N. Y., has filed aritcles of incorporation with a capital stock of $100,000 to manufacture storage batteries. The incorporators are: H. M. Browne, E. J. Forhan and D. M. Barrett, all of New York, N. Y.

THE AMERICAN VALVE COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 to manufacture and deal in valves of all kinds. The officers of the company are: C. H. Tebbetts, of Marshfield, president, and A. B. Grover, of Winchester, Mass, treasurer.

THE UNITED MANUFACTURERS, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing engines, machinery and tools. The incorporators are: Ernest M. Munn, Jr., A. Straussman, Walter K. Griffin, all of New York, N. Y.

THE ADVANCE ELECTRICAL COMBINATION COMPANY, of Pittsburg, Pa., has been incorporated by J. E. Womser, J. Womser and J. McPherran, all of Pittsburg, Pa. The company is capitalized at $200,000, and proposes to manufacture, sell and deal in all kinds of electrical appliances and contrivances.

THE S. H. COVET ELECTRIC MANUFACTURING COMPANY, of Portland, Maine, has been incorporated with a capital stock of $200,000 to deal in telephone and electrical merchandise. The officers of the company are: L. V. Walker, president; F. L. Pennell, treasurer, and Levi Turner, clerk, all of Portland, Maine.

THE SNYDER RAILWAY SPECIALTY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by Benjamin F. Blair, of Glen Ridge, N. J.; Joseph A. Burdeau, of New York, N. Y., and Louis F. Starr, of Brooklyn, N. Y. The company proposes to manufacture and deal in railway specialties.

THE NEIBLA MANUFACTURING COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $50,000 to carry on a mechanical and electrical engineering business and as machinists and metal workers. The incorporators are: A. Albion, F. C. Lambert, of Brooklyn, N. Y., and P. Lichtenstein, of New York, N. Y.

THE AMERICAN ELECTRIC FIRE ALARM MANUFACTURING COMPANY, of Pittsburg, Pa., has been chartered with a capital stock of $500,000 to manufacture and deal in electric fire alarms, etc. The incorporators are: Charles H. Hallowell, of Carnegie, Pa.; William Johnson, of Bellger, Pa., and John C. Miller, of Beaver, Pa.

New Incorporations.

WILMINGTON, DEL.—The Albion Light & Power Company has been incorporated with a capital stock of $100,000. The incorporators are: E. L. Laurie, G. W. Dorsey, Jr., and W. G. Stayton, all of Wilmington, Del.

AUGUSTA, GA.—The Georgia-Carolina Power Company has been granted a charter with a capital stock of $500,000. The company proposes to erect a power plant at Stevens Creek, which is located about two miles above the Augusta Locks, where about 8000 hp will be developed. J. L. Hankinson, W. G. Lancaster, N. B. Dial and others are interested in the project.

GLASFORD, ILL.—The Harkers Corners & Glasford Telephone Company has been chartered with a capital stock of $1,500 by D. J. Cowser, S. A. McQuown and N. T. Parr.

SHOBONIER, ILL.—The Vernon & Shobonier Telephone Company has been chartered with a capital stock of $800 by R. F. Emerson, A. G. Wilson and E. A. Thomas.

VIENNA, ILL.—The Johnson Mutual Telephone Compnay has been incorporated with a capital stock of $5,000 by A. J. Kuykendall, Guy Beauman, C. E. Ferris, J. W. Casper and W. E. George.

UNION, KY.—The Union Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are: George W. Jolly, S. S. Miller, J. M. Moore, J. G. Evans, H. A. Yancey, A. L. Ramage and J. W. Robertson.

THREE OAKS, MICH.—The Chikaming & Weesaw Telephone Company has filed articles of association with a capital stock of $2,000.

WHITEFORD CENTER (P. O. OTTAWA LAKE), MICH.—The Whiteford Farmers' Telephone Company has been incorporated with a capital stock of $10,000.

BROWN VALLEY, MINN.—The Brown Valley Telephone Company has been incorporated with a capital stock of $50,000. S. Y. Gordon is president and N. J. Brown, secretary.

MINNEAPOLIS, MINN.—The Lake Harriet Electric Company has been organized, with a capital stock of $75,000, to construct an electric light plant to furnish electricity in the Linden Hills district. The officers of the company are: C. J. Gotshall, president; D. F. Darling, vice-president; C. L. Bostwick, secretary; H. B. Domberg, treasurer, and Truman Hibbard, general manager.

JEFFERSON CITY, MO.—The Missouri Electric, Gas & Water Company has been chartered, with a capital stock of $50,000, by Harry H. Tyson, Joseph Barbo, W. Goodall and others.

JEFFERSON CITY, MO.—A certificate of incorporation has been issued by the Secretary of State to the Pittsburg & Kansas City Railway Company, which proposes to construct an electric railway from Burgess, Mo., to Pittsburg, Kan., a distance of 50 miles. The capital stock is placed at $500,000, and the incorporators are: John W. Ground, William M. Calhoun, Thomas K. Irwin and F. H. Fitch.

MISSOULA, MONT.—The Missoula Street Railway Company has been incorporated, with a capital stock of $100,000, to construct an electric street railway in Missoula, for which the City Council has granted a 50-year franchise. The directors are: J. R. Wharton, W. A. Clark, Jr., and W. M. Bickford, of Butte; S. R. Luch, of Missoula, and C. B. McBroom, of Spokane, Wash.

VINELAND, N. J.—The Maurice River Light, Heat & Power Company has been organized for the purpose of constructing a dam and power plant to furnish electricity in Vineland. The officers of the company are: E. W. Maloney, of Avondale, Pa., president; E. C. Potter, of Vineland, N. J., vice-president; Marcuse Fry, of Vineland, N. J., secretary and treasurer.

PORT JERVIS, N. Y.—Articles of incorporation have been filed for the Port Jervis & Delaware Valley Railroad Company by F. A. Sawyer, of New York, N. Y.; E. Porter Emerson and Dr. W. F. Cuddeback, of Port Jervis, N. Y. The company is capitalized at $10,000 and proposes to construct and operate an electric railway, one mile in length, from a point in Port Jervis to a connection with the Port Jervis, Monticello and Summitville Railroad Company.

SMITHFIELD, N. C.—The Ivanhoe Manufacturing Company has been chartered, with a capitalization of $300,000, by W. M. Sanders, of Smithfield, and associates to build a cotton mill. The company proposes to generate and distribute electricity and also has the right to build and operate electric railways.

BOSTONIA, N. D.—The Kidder County Telephone Company has been organized with V. Stramberg as secretary.

BROFY, N. D.—The Emmons County Telephone Company has been organized, with a capital stock of $4,000, and the following-named officers: C. A. Ward, president, and William Foell, secretary.

FARGO, N. D.—The Harvey Telephone Company has been incorporated with a capital stock of $50,000 by R. M. Hamilton, D. F. Singfried, of Fargo, N. D., and A. Peterson, of Harvey, N. D.

JAMESTOWN, N. D.—The Wright-Allen Telephone Company has been incorporated to construct a telephone line 10 mines in length. James Wright is secretary.

STEELE, N. D.—Articles of incorporation have been filed for the Kidder County Telephone Company, with a capital stock of $10,000, by John B. and Mary F. Spangler, of Steele, N. D., and George B. Perham, of Fargo, N. D.

CLARINGTON, OHIO.—The Clarington Water & Electric Company has been incorporated, with a capital stock of $35,000, by T. V. James and others.

HARRISON, OHIO.—The Johnson Fork Telephone Company has been incorporated to build, equip and operate a telephone system throughout Franklin and Dearborn Counties in Indiana, with the principal exchange at Johnson Fork. The post office address of the directors is Harrison, Ohio. H. G. Larue is president and Albert Mettler, secretary.

RESACA (P. O. PLAIN CITY), OHIO.—The Resaca Farmers' Telephone Company has been incorporated, with a capital stock of $10,000, by W. R. Bigelow and others.

CHICHASHA, OKLA.—Articles of incorporation have been filed for the Chichasha Gas & Electric Light Company, with a capital stock of $175,000, by Lawrence Martin, Dennis O'Brien, A. A. Humphreys and C. E. Ross.

DOXEY, OKLA.—The Beulah Union Telephone Company has been incorporated with a capital stock of $5,000. The company would like to receive prices on poles and telephone supplies at once. For further information address Frank T. Alexander.

GIBSON, OKLA.—The Sims-Renner Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The directors are: J. W. Sims, Gibson, Okla; W. S. Kinnet, W. A. Renner and J. H. Renner, of Looney, Okla.

HOBART, OKLA.—The Southern Rural Telephone Company has been incorporated with a capital stock of $375 by Charles F. Nailer, J. M. Humbert, John Forsyth and A. R. Forman.

LACEY, OKLA.—Articles of incorporation have been filed for the Lacey & Western Telephone Company, with a capital stock of $3,000, and the following named directors: J. D. Patton, of Hennessey; W. S. Kinnett, J. A. Kinnett and T. E. Willis, of Lacey.

RUSH SPRINGS, OKLA.—The Isabella-Rush Springs Independent Telephone Company has been organized, with a capital stock of $10,000, to operate a local exchange at Rush Springs and Isabella with rural telephone lines between the two places. The directors are: J. A. Carver, W. T. Ruby, C. W. Runkin, A. C. Camp and W. E. Perkins, all of Rush Springs, Okla.

TALOGA, OKLA.—Articles of incorporation have been filed for the Taloga & Dewey County Telephone Company with a capital stock of $5,000 by W. B. Wixon, Pearl Wilson and others, of Taloga.

BEND, ORE.—The Crook County Water, Light & Power Company has filed articles of incorporation to build an electric railway from Redmond to Prineville; also to construct and operate power plants. The company is capitalized at $50,000. J. H. Jackson, of Redmond, Ore., is president.

MOSIER, ORE.—Articles of incorporation have been filed for the Mosier Valley Telephone Company by A. P. Bateham, J. K. McGregor and Lee Evans. The capital stock of the company is placed at $1,200.

SALEM, ORE.—Articles of incorporation have been filed for the Elkhorn Light & Power Company, with a capital stock of $10,000, by F. A. Harmon, L. Summers and John L. Rand.

CHAMBERSBURG, PA.—The Letterkenny Telephone Company has been organized to erect a rural telephone line in Franklin County. The line will be 15 miles in length and will intersect Hamilton Township at Keyler's. The officers of the company are: Reuben Rife, president; William B. Schaeffer, secretary, and Daniel Hunsecker, treasurer.

GREENVILLE, PA.—The Osgood Telephone Company has been organized with Henry Green as president and Thomas Barrows, secretary. The company proposes to cover every township in the northern and eastern part of Mercer County. The company will extend its telephone line to Greenville to connect with the Bell system in this place. It also plans to extend its lines in Crawford County, east of Atlantic.

PINE GROVE, PA.—The Pine Grove & Cressona Rural Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The directors are: C. H. Maidenford, of Pine Grove, R. F. D. No. 3, is treasurer; A. J. Fidler, of Rock, Pa.; George Berger, Pine Grove, R. F. D. No. 2; Frank Rubert, of Cressona, Pa., and others.

YOUNGSVILLE, PA.—The Brokenstraw & Stillwater Telephone & Telegraph Company has been incorporated, with a capital stock of $25,000. The directors are: John A. Day, of Youngsville, treasurer; Frank D. Kinnear, of Youngsville, and W. A. Alexander, of Warren, Pa.

ARDMORE, S. D.—The Ardmore Telephone Company has been incorporated, with a capital stock of $3,750, by James A. Dell, of Laurson; Charles S. Williams, Scott W. Hill, Jay F. Blessing, of Ardmore, S. D., and Chester L. Jenson, of Hot Springs. The company proposes to construct a telephone line from Ardmore to Edgemont, S. D.

GARY, S. D.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $20,000 by F. H. Greene, A. E. Fales and George W. Horton.

CORNERSVILLE, TENN.—The Cornersville Telephone Company has been incorporated by W. B. London, A. Jones, W. G. Wilkinson and others.

DOWELLTOWN, TENN.—The Riverside Home Telephone Company has been incorporated, with a capital stock of $3,000, by B. W. Robinson, James Davenport, Herman Williams and others.

DOWELLTOWN, TENN.—The Dowelltown Home Telephone Company has been chartered with a capital stock of $3,000 by B. W. Robinson, James Davenport, Herman Williams, M. B. Scott, C. B. White and others.

NASHVILLE, TENN.—The Temperance Hall Home Telephone Company, of DeKalb County, has been incorporated with a capital stock of $1,000 by R. S. Reynolds, J. H. Sykes, J. P. Turner, J. H. Close and R. W. Mason.

NEW MIDDLETON, TENN.—The New Middleton Home Telephone Company has been incorporated by W. H. Williams, R. M. Baird, A. F. Barry and James Barrett.

ROGERSVILLE, TENN.—The Rogersville Telephone & Telegraph Company has been incorporated with a capital stock of $5,000 by W. D. Harmon, George A. Smith, J. A. Thompson, G. S. Stansill and A. T. Bowen.

HAMILTON, TEX.—The Hamilton-Hico Telephone Company has been chartered, with a capital stock of $20,000, by J. F. Weiser, V. F. Weiser, of Hico, Tex., and Sydney G. Ross, of Hamilton, Tex.

ROGERSVILLE, TEX.—Articles of incorporation have been filed for the Rogersville Telephone & Telegraph Company, with a capital stock of $5,000, by W. D. Harmon, G. A. Smith, J. A. Thompson and others.

ROBINSON, UTAH.—The Tintic Power & Supply Company has been incorporated, with a capital stock of $5,000. The officers are: William J. Adams, president; John Adams, vice-president, and George Jones, secretary and treasurer.

SALT LAKE CITY, UTAH.—The Yellowstone Telephone Company has been incorporated, with a capital stock of $25,000, to construct a telephone line from Ashton, Idaho, to Yellowstone, Mont.

ALTA VISTA, VA.—The Alta Vista Land & Improvement Company has been chartered, with a capital stock of $200,000. The charter of the company gives it the privilege of developing water power to generate electricity for lamps and motors, etc. The officers of the company are: T. V. Elsom, president; W. G. Lane, vice-president; E. B. Harris, secretary, and P. F. Hardison, treasurer.

EMPORIA, VA.—The Emporia Hydro-Electric Power Company has been incorporated, with a capital stock of $200,000. The officers of the company are: W. Samuel Goodwin, president; G. B. Wood, vice-president; W. F. Deal, treasurer.

SEATTLE, WASH.—The Puget Sound & Pacific Power & Irrigation Company has been chartered, with a capital stock of $4,000,000, by Frank McKean and others.

SNOHOMISH, WASH.—The Everett & Tacoma Railway Company has been incorporated, with a capital stock of $2,500,000. The incorporators are: G. M. Cochran, E. Colburn, E. L. Colburn, Edgar Wright and O. E. Crossman, all of Snohomish.

WINLOCK, WASH.—Articles of incorporation have been filed for the Winlock Home Telephone Company, with a capital stock of $5,000, by J. A. Veness, Andrew Johnson and A. W. McFee.

CASHTON, WIS.—The Cashton Telephone Company has been chartered, with a capital stock of $14,000, by C. H. Cremer, Henry H. Cremer and Anna Schemmger.

FORESTVILLE, WIS.—Articles of incorporation have been filed for the Maplewood Western Telephone Company with a capital stock of $500 by Gustave Deige, Charles Hoepner and Henry Leige.

WESTBORO, WIS.—A temporary organization has been formed, to be known as the Westboro Telephone Association, to erect a party line and install a switchboard as soon as a sufficient number of subscribers are secured. J. W. Kaye is president and general manager, and C. C. Lord, secretary and treasurer.

TORRINGTON, WYO.—The Torrington Mutual Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The officers are: William G. Curtis, president, and W. B. Coy, secretary.

REGINA, SASK., CAN.—The following rural telephone companies have been incorporated: Florence Rural Telephone Company, South Antler Rural Telephone Company and the Silverton Rural Telephone Company. For further information address Francis Dagger, provincial telephone expert, Regina, Sask.

Legal.

CONTRACT DECLARED ILLEGAL.—Judge Z. A. Littlejohn in a decision rendered Feb. 12 declares the contract entered into between the city of Americus, Ga., and the Americus Railway & Lighting Company nearly two years ago illegal. The company had secured certain franchises and contract for 20 years, which included lighting the city, pumping the water supply and construction of an electric street railway. The City Council recently instituted proceedings to have the contract declared illegal. The company will appeal from the decision as rendered.

Personal.

MR. ANSON W. BURCHARD, assistant to the president of the General Electric Company, has been elected a trustee of Stevens Institute.

MR. F. G. SIMMONS presented a paper at the first annual meeting of the Wisconsin Society of Engineers, held at Madison, Feb. 24-26, entitled "The Electric Interurban Roads of Wisconsin."

MR. G. C. LLOYD has resigned as secretary of the British Institution of Electrical Engineers to become secretary of the Iron and Steel Institute. Mr. P. F. Rowell, assistant secretary of the I. E. E., succeeds Mr. Lloyd as secretary.

MR. WILLIAM S. HEGER, assistant to President W. H. Whiteside, of the Allis-Chalmers Company, has gone to California to spend a few months in the favorable climate of that State for the benefit of Mrs. Heger's health.

MR. W. C. BRYANT and his wife, accompanied by Mr. and Mrs. Harvey Hubbell, have gone on a trip to California for a month. It will be a complete holiday, the affairs of the Bryant Electric Company and of the Hubbell factory being left entirely behind.

DR. SAMUEL SHELDON, who has been in ill health for some time, will sail for Europe this week, where he will remain until October. During his absence Dr. Tufts, of Columbia University, will conduct Dr. Sheldon's course at the Brooklyn Polytechnic Institute.

MR. L. G. NILSON, chief engineer of Strang Gas Electric Car Company, of 15 Wall Street, New York City, has been elected president of Nilson-Miller Company, of 1300 Hudson Street, Hoboken, N. J. He will continue as consulting engineer for the Strang company.

MR. A. W. McLIMONT, electrical engineer of the Public Service Commission, First District, has resigned his position to accept the position of general manager of the Chicago & Milwaukee Electric Railway Company, of Chicago, Ill. His successor has not yet been appointed.

MR. HENRY R. TOWNE, president of the Yale & Towne Manufacturing Company, has been unanimously elected president of the Merchants' Association of New York. Mr. Towne has always taken an active interest and share in public matters and is well fitted to direct the affairs of this influential body.

MR. W. F. FOSHAY, who resigned the managership of the Fort Dodge (Ia.) Light & Power Company, to take effect March 1, was the subject of a highly complimentary notice printed in the columns of the Fort Dodge *Messenger*, dated Feb. 23, which included flattering testimonials from a number of prominent business and professional men.

MR. W. P. BOWMAN, formerly manager of the Cleveland branch of the John A. Roebling's Company, of New York, has been appointed successor in the treasurership to Mr. Henry L. Shippy, who has just resigned on account of serious ill health. Mr. Bowman has assumed his new duties, to which he brings a ripe experience and a wide knowledge of the field.

COL. FRANK S. RICHARDSON, of North Adams, Mass., was elected a trustee of the Massachusetts Lighting Companies at the annual stockholders' meeting held Feb. 16. Col. Richardson was owner and general manager for 31 years of the North Adams Gas Light Company including its electrical properties, which was recently purchased by the Massachusetts Lighting Companies.

MR. FRANK J. CLARK, of Springfield, Mass., Eastern representative of the Zucker, Levett & Loeb Company, of New York, N. Y., manufacturers of dynamos and electroplating supplies, has resigned his position to become a member of the Levett Manufacturing Company, of Matawan, N. J., which will manufacture the same line of goods. Mr. Clark will be the Eastern representative of the firm.

MR. J. W. WAGGENER, formerly superintendent of the Atchison Railway, Light & Power Company, of Atchison, Kan., has been appointed general manager of the company. Mr. Harry Askin, who rebuilt the lighting plant last July, succeeds Mr. Waggener as superintendent. Mr. Askin has advanced in the last six months from chief electrician to assistant superintendent, and now to superintendent.

MR. LAURENCE WHITRIDGE CADY, who was formerly electrical engineer for the W. J. Barr Electrical Manufacturing Company, has been made electrical engineer of the Browning Engineering Company and has been working upon their electric locomotive cranes and other conveyor machinery. He has recently designed a new line of lifting magnets. His headquarters are at the main office in Cleveland, Ohio.

MR. TURE N. STEEN, of Stockholm, Sweden, is now visiting this country and is spending some time in California. On his return to Sweden he desires to take with him various American electrical specialties and mechanical devices for representation and manufacture over there, with Swedish capital. He can be addressed in care of the ELECTRICAL WORLD. He has been to this country before and has many acquaintances here.

MR. A. E. WINCHESTER, the commissioner and superintendent of the municipal electric light plant at South Norwalk, Conn., is a candidate for one of the commissionerships on the new Public Service Commission of Connecticut when it is organized. Mr. Winchester is in many ways an ideal occupant of such a post, combining high integrity and intelligence with a very thorough knowledge of the art of illumination and of practical public service conditions.

MR. H. M. HUXLEY.—The patent law firm of Brown & Williams, of Chicago, of which Mr. C. A. Brown is the senior member, announces that Mr. Henry M. Huxley, A. M., a graduate of Harvard in 1902, has become associated with their office. He will deal specially with chemical and metallurgical work. He was at one time in the operating department of the American Steel & Wire Company and more lately assistant general manager and manufacturer of the Duplex Metals Company.

MR. J. E. FRIES, a Swedish electrical engineer who has been for some time in this country, has joined the Crocker-Wheeler forces at Ampere, N. J., and has been assigned to a position on the engineering staff under Mr. Gano Dunn, chief engineer of the company. Mr. Fries has already had considerable experience on this side of the water, especially with the Allis-Chalmers Company at Milwaukee, and more recently with the Canadian General Electric Company at Toronto. He has made a great many friends, who note this new and important connection with much pleasure.

MR. F. A. WILKINSON, the electrical engineer and manager at St. Marylebone, London, England, has resigned his appointment in order to take up private practice. He has entered into an arrangement under which he remains at Marylebone until the end of September or for six months after his successor takes up his full duties—whichever is the later date. He is now at liberty to carry out such private work as will not interfere unreasonably with his duties at Marylebone. Mr. Wilkinson intends to devote his attention particularly to colliery work, electric battery traction, electric heating and cooking, etc., following up the work that has been carried out in this direction at Marylebone.

MR. H. L. SHIPPY.—It is with profound regret that the many friends of Mr. Henry L. Shippy have learned that owing to the condition of his health he has felt it necessary to be relieved of active business cares, and has therefore resigned as treasurer of John A. Roebling's Sons Company, of New York. His connection with the Roebling interests began in 1875 and has continued ever since without any interruption. In these 35 years Mr. Shippy has made friendships and acquaintances in all parts of the globe, and has become perhaps the most widely known and widely traveled American of his day in the mechanical world. At home his manly qualities, his high business ideals and his kindliness of heart have endeared him everywhere, while in the electrical fields they are legion who are proud to claim his intimacy and friendship. No one could be more warmly esteemed than he is, and into his retirement he takes a wealth of good wishes.

Obituary.

MR. THOMAS TAYLOR JOHNSTON died Feb. 23 at his residence in Evanston, Ill. Mr. Johnston was consulting engineer for the Snoqualmie Falls (Seattle) hydro-electric plant, unique among electrical plants from having the machinery located at the bottom of the tunnel pit. At the time of his death he had supervision of the hydraulic engineering features of the Chicago Drainage Canal. Mr. Johnston was president of the Western Societies of Engineers in 1897.

MR. JAMES E. PETTIT, a well-known telegraph operator and for many years chief operator of the Postal Telegraph Company's Chicago office, died at his home in Oak Park, Chicago, Feb. 23. Mr. Pettit was a military telegrapher and served through the Civil War, during which period he spent nine months in a confederate prison. He was secretary of United States Military Telegraph Corps for 25 years. At the time of his death he was on the pension roll of the Postal Telegraph Company. Deceased was born in Perry, N. Y., March 21, 1842.

DR. C. D. WRIGHT.—We regret to note the death of Dr. Carroll D. Wright, president of Clark College; once Commissioner of Labor of the United States. He was a leading statistician, educator and philanthropist, and in every way a useful public-spirited citizen. In the early stages of his career Dr. Wright practised in Boston as a patent attorney, and had Mr. T. A. Edison among his clients. He took out the first Edison patent—that on the vote recorder; and liked to tell of his recollections of Edison as a raw, intensely earnest youth. One of the things Edison was then interested in was the conversion of cerebral action—thought—directly into mechanical motion; and he gave Mr. Wright some quite unconvincing demonstrations.

Trade Publications.

BATTERY JARS are listed and illustrated in a 387-page catalog devoted to bottles issued by the Illinois Glass Company, 212 Randolph Street, Chicago, Ill.

NERNST LAMPS.—Volume VI, No. 7 of "The Glower," published by the Nernst Lamp Company, Pittsburg, Pa., contains a full illustrated description of the Nernst lighting system used in Tacoma, Wash.

MOTOR-DRIVEN BOTTLE WASHERS for alternating current and direct current are illustrated, listed and described in Bulletin No. 3960 of the Emerson Electric Manufacturing Company, St. Louis, Mo.

OPALUX SHADES.—The Central Electric Company, Chicago, Ill., has issued a new bulletin descriptive of Opalux shades and reflectors, an entirely new line of appliances especially designed for use with tungsten lamps.

WIRE NOVELTIES.—The Wire Novelty Manufacturing Company, West Haven, Conn., has issued an illustrated pamphlet showing a few of the articles manufactured by it for the tinware, hardware and manufacturing trade.

TUNGSTEN LAMPS.—The economy of tungsten lamps is shown in a convincing manner in a folder being distributed by the Buckeye Electric Company, Cleveland, Ohio. This folder gives cost calculations based on actual operating conditions.

PIPE TAPLETS are discussed in a convincing manner in Bulletin No. 63 of the H. T. Paiste Company, Philadelphia, Pa. A supplement to this bulletin deals with a pull socket which is said to be capable of withstanding 12,000 makes and breaks.

CARPET SWEEPERS.—Folder No. 4122 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., gives an outline of electric-motor-driven carpet sweepers manufactured by the Electric Suction Sweeper Company, of Canton, Ohio.

SERIES TUNGSTEN LAMP SYSTEM.—Bulletin No. 5533 of the Western Electric Company, Chicago, Ill., gives an excellent technical discussion of constant-current regulators for series tungsten systems receiving energy from alternating-current mains.

DIRECT-CURRENT INSTRUMENTS for switchboard use are illustrated and described in Bulletin No. 4643 of the General Electric Company, Schenectady, N. Y. The instruments are circular in shape and have prominent legible and well-lighted scales.

POLYPHASE MOTORS of the wound-rotor and squirrel-cage induction types are illustrated and described in detail in Bulletin 82 of the Wagner Electric Manufacturing Company, St. Louis, Mo. Auto-transformer starters for the squirrel-cage motors are also discussed.

ELECTRIC CARRIAGES for high-class service, including runabouts, stanhopes, victorias, coupes, surreys, broughams and landauletts, are neatly illustrated and well described in a catalog recently issued by the Rauch & Lang Carriage Company, Cleveland, Ohio.

GAS ENGINES.—Bulletin No. 1063 has been issued by the Allis-Chalmers Company to direct attention to the vast field of power service available to gas engines and the economies afforded by their utilization of either producer gas, natural gas or furnace gas.

TELEPHONES intended for severe service, such as that required in coal mines, are outlined in a return post card being issued by the Stromberg-Carlson Manufacturing Company, Rochester, N. Y. These telephones are of the iron-clad rust-proof water-tight type.

BUILDERS' HARDWARE.—The Merchant & Evans Company, Philadelphia, Pa., has issued a 189-page catalog devoted to all kinds of builders' hardware. The catalog contains a complete set of rules of the Master Sheet Metal Workers for the proper laying of tin roofing.

MACHINERY SUPPLIES for manufacturers and users of machinery and steam boilers, implement manufacturers, sheet metal workers, structural workers, railroads, mines, etc., are described in the February issue of the Monthly Journal and Stock List of Joseph T. Ryerson & Son, Chicago, Ill.

STEAM PUMPS.—Pony Catalog No. 76 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., deals with a few of the standard styles and sizes of this company's line of steam pumps. Illustrations are given of the various pumps, together with considerable data relating to dimensional details and output ratings.

PANEL BOARDS.—Bulletin No. 23 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., contains a complete price list of various types of high-grade and commercial-grade panel-board switches and panel units. These devices are designed for 125-volt and 250-volt two-wire and three-wire circuits.

TUNGSTEN LAMPS.—The economy of operation of tungsten lamps in comparison with incandescent lamps of other types is strikingly shown in bulletin No. 6D, issued by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio. The lamps described are those intended for constant-voltage circuits.

ELECTRICAL TESTS.—The Electrical Testing Laboratories, Eightieth Street and East End Avenue, New York., have issued in booklet form a paper entitled "The Work of the Electrical Testing Laboratories," by Mr. W. S. Howell. This paper describes the various commercial tests which the laboratories are called upon to make.

ELECTRIC BRAKES.—Friction brakes of the magnetic type for direct-current and alternating-current motors are technically described in circular No. 1158 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. These brakes are intended particularly for use with crane and hoist motors, and motors used in steel mills.

FIBER CONDUIT.—The second edition of the general catalog of the Fiber Conduit Company, Orangeburg, N. Y., is a well-printed 84-page publication devoted to fiber conduit. Numerous illustrations are given of conduits in process of installation, while complete price lists of the various sizes of conduits and cost of installation are included.

ELECTRIC WELDERS.—An illustrated folder devoted to electric welders has been issued by the Toledo Electric Welding Company, 141 Tenth Street, Toledo, Ohio. The welders described vary in size from 250 lb. to 1250 lb. Considerable information is given concerning the energy and time required for making welds of certain sizes.

TRANSFORMERS.—Single-phase transformers of the core type rated at from 0.6-kw to 50-kw are described in detail in a catalog issued by the American Transformer Company, of Newark, N. J. These transformers are constructed of silicon steel cores, which possess non-ageing properties, in addition to low specific hysteresis and eddy-current losses.

MERCURY RECTIFIERS for charging storage batteries are discussed in an instructive manner in circular No. 1148 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. The rectifier outfits described in this circular are designed for from 5 to 30 amperes. An automobile battery charging outfit is described in folder No. 4105 of the same company.

DIRECT-CURRENT SWITCHBOARDS.—The F. Bissell Company, 226 Huron Street, Toledo, Ohio, has issued bulletin No. 19, covering switchboards for 125-volt and 250-volt direct-current isolated and central-station plants. The bulletin contains complete price lists of all of the switchboards, instruments, switching devices and circuit breakers illustrated and described.

HEATING DEVICES.—The Excel Electric Heating Company, 237 Broadway, New York, has issued a well-executed catalog descriptive of electric heating devices, including coffee percolators, smoothing irons, chafing dishes, food warmers, double boilers, shaving outfits, glue pots, wax heaters, sterilizers and soldering irons. Each of these devices is illustrated, listed and described.

GAS ENGINES.—Gas engines for driving electric generating outfits, air compressors and vacuum cleaning equipments are illustrated and listed in a folder issued by the Trebert Gas Engine Company, 35 Ford Street, Rochester, N. Y. Complete details of a self-contained electric generating unit designed to supply energy to 10 8-cp lamps are given in special pamphlet issued by the same company.

HYDRAULIC TURBINES are well illustrated in a descriptive catalog of the Dayton Globe Iron Works Company, Dayton, Ohio. This catalog gives much valuable information concerning the measurement of water powers, the construction of head races, wheel pits and tail races, and the arrangement of wells, etc. Illustrations are given of numerous installations in which American turbines are employed.

THE TUNGSTEN LAMPS.—The General Electric Company, Schenectady, N. Y., in Bulletin No. 4646 presents interesting data relative to the quality of light produced by the tungsten lamp, simplicity of construction of the lamp, its adaptability to both alternating and direct current circuits, and various other data relative to its life and economy. The bulletin contains also descriptions and illustrations of Holophane reflectors for use in connection with tungsten lamps.

DIRECT-CURRENT WATT-HOUR METERS.—The Duncan Electric Manufacturing Company, of Lafayette, Ind., has issued bulletin No. 8, which gives illustrated technical descriptions of watt-hour meters for direct-current house service. These instruments are driven by means of commutator type motors. They are provided with visual bearings; fire proof binding posts; non-twisting brushes; low temperature coefficient resistance, and an arrangement for compensating for friction and vibration.

DIRECT-CURRENT GENERATORS.—A list of engine-type, direct-current generators sold by the Crocker-Wheeler Company, of Ampere, N. J., is given in its Bulletin No. 110. This list, covering 15 solid pages, gives the names and addresses of companies and individuals using these generators. Generators in industrial plants, street railways, railroad and other machine shops, office buildings, stores, schools and residences are included in the list. Among the stations are several on United States battleships.

ELECTRIC CARRIAGES.—The Rauch & Long Carriage Company, Cleveland, Ohio, has issued a beautiful pamphlet illustrating and describing its 1909 types of electric vehicles. In design the publication is artistic, and in execution represents the highest state of the printing and engraving arts. One notable feature is that in illustrating vehicles, each type is shown in a photographic reproduction, bringing out every detail, and a supplementary engraving from a free-hand drawing representing the machine as it appears in service on the street or road.

LIGHTING SPECIALTIES.—Bulletin No. 101 of the Marshall Electric Company, 301 Congress Street, Boston, Mass., gives illustrations, descriptions and price lists of lamp sockets for all purposes. Pipe ends for open-conduit wiring are treated in detail in bulletin No. 102, while switches, receptacles, plugs and wall cases are treated in bulletin No. 103 of the same company. The company has also issued an illustrated catalog and price list, printed in Spanish, devoted to lamp sockets and receptacles, porcelain base switches, rosettes and extension plugs.

MOTORS IN RAILROAD SHOPS.—In bulletin No. 4649, just issued by the General Electric Company, Schenectady, N. Y., the relative advantages and disadvantages of "independent drive" and "group drive" of machine tools are demonstrated. While the title of the bulletin refers to railroad shops, the data are applicable to machine shops in general. The bulletin refers also to the relative merits of alternating current and direct current for use in this connection, and it contains numerous illustrations of machine tools operated by electric motors.

ELECTRIC TOOLS.—The Virginia Electric Tool & Manufacturing Company, Petersburg, Va., has issued bulletins relating to its line of electric tools. Bulletin No. 1 is devoted to hammers for general service for use on direct-current circuits. Bulletin No. 2 deals with plug drills. An electric hammer for riveting, chipping, calking and other work is described in Bulletin No. 3. This hammer is provided with a plunger which is operated by magnetism of an alternating nature produced by a commutated direct current. The commutating mechanism is arranged on a base plate entirely separated from the hammer proper. The hammer is, therefore, extremely simple.

GAS ENGINES AND PRODUCERS.—A well-prepared catalog issued by the Du Bois Iron Works, Du Bois, Pa., contains a table compiled from data gathered in actual practice from producer-gas and steam-generating plants, tending to show the relative economy of the former. Much detailed information is given concerning the constructive features and operating characteristics of single-cylinder, tandem and twin-tandem engines, arranged to operate with natural illuminating or producers' gas. Producer gas plants are also described, while the construction features of these plants are compared with those of steam-generating plants by means of illustrations, which show the heat losses in the various parts of the two equipments.

PUMPS.—Pumps of various types are illustrated and described in bulletins recently issued by the Blake & Knowles Steam Pump Works, 115 Broadway, N. Y. Bulletin B K-825 is devoted to vertical triplex single-acting pumps. These pumps are intended for belt drive and are suitable for operation with electric motors. Numerous forms of starting device for electric motors are illustrated in this bulletin. Double-acting piston-pattern pumps of the triplex type for belt driving are described and illustrated in bulletin B K-826. Bulletin B K-827 deals with pumps for artesian and curb wells. These pumps are rated at from 10 to 640 gallons per minute. Illustration is given of a triplex electric sinking pump, self-contained and complete with the electric motor. Belt-driven and steam-driven ammonia pumps are illustrated and described in bulletin B K-828, which also gives information concerning constructive details of these pumps.

Business Notes.

THE EATON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., manufacturers of switchboards, panel boards, steel cabinets, etc., announces that, owing to increasing business, it will move about March 15 to new and more commodious quarters at 46 North Carpenter Street.

THE DUBOIS IRON WORKS, DuBois, Pa., manufacturers of "Du-Bois" gas engines and steam and power pumps, has been awarded a contract for a 160-hp twin tandem gas engine, direct connected to 100-kw generator for the lighting plant of the Seventy-fourth Regiment State Armory Building at Buffalo, N. Y.

J. E. LONERGAN & CO., brass founders and finishers, 211 Race Street, Philadelphia, Pa., have announced that their business will hereafter be conducted under the title of J. E. Lonergan Co. Mr. J. E. Lonergan is president; Mr. M. A. Hudson, vice-president; H. S. Whitney, secretary, and W. E. Crofton, treasurer.

THE RIDGWAY DYNAMO & ENGINE COMPANY, Philadelphia, Pa., has sold to the Commissioners of Public Works, Orangeburg, S. C., a Ridgway tandem-compound, side-crank engine arranged for direct connection to a 90-kw Ridgway alternating-current generator. This is the third Ridgway unit in the Orangeburg electrical and pumping plant.

MR. E. E. HUDSON, formerly manager of sales of the Battery Supplies Company, Newark, N. J., has been appointed manager of sales of the primary battery department of the Edison Manufacturing Company, Orange, N. J. This company announces that it has discontinued its sales office at 10 Fifth Avenue, New York City, and that all communications should hereafter be addressed to Edison Manufacturing Company, Orange, N. J.

THE HARVARD ELECTRIC COMPANY, Chicago, Ill., requests us to deny a rumor that it had discontinued, or intended to discontinue, the manufacture and sale of Harvard brackets. Mr. Frederic Greer, president of the Harvard Electric Company, says he prefers to believe that this impression (which was given out by a manufacturer of a bracket similar to the Harvard galvanized channel steel bracket) was done through an honest lack of knowledge of the Harvard business.

MR. GEORGE B. DUSINBERRE, of Cleveland, who is well-known to the electrical fraternity both as a consulting engineer and on account of his former connection with the Westinghouse Company, has recently been appointed sales agent for the Middle West for the American Electric Fuse Company, of Muskegon, Mich., and for the Duplex Metals Company, of New York. Mr. Dusinberre will continue to make his headquarters in Cleveland, and has moved his office to 414 Prospect Avenue.

INSTALL MOORE TUBE LIGHTS.—The Moore Electrical Company, Newark, N. J., has recently installed its tube lights in a number of the large silk dyeing establishments of Paterson. Among the recent sales are: Two 66-ft. white units, one 66-ft. yellow unit and two 114-ft. "straight rim" yellow units to the Weidman Silk Dyeing Company; one 66-ft. white tube and one 114-ft. yellow hairpin tube to Formanns, Stumpf & Sharpe. It is claimed that these lights are especially adapted to matching colors.

THE HOSKINS MANUFACTURING COMPANY, formerly the Hoskins Company, of Chicago, has opened its new plant and general offices at 453 to 471 Lawton Avenue, Detroit, Mich. Here the company has an extensive factory, new equipment and enlarged facilities for making and distributing its line of electric furnaces, pyrometers and heating appliances. With the reorganization and increase of capital to $500,000, the management remains the same as before. The officers of the company are as follows: Hoyt Post, president; W. W. Talman, vice-president and sales manager; E. F. Hoskins, general manager and treasurer; Jonathan Palmer, Jr., secretary. A. L. Marsh will continue with the company in the capacity of electrical engineer.

CROCKER-WHEELER SALES.—The business booked during the week by the Crocker-Wheeler Company, Ampere, N. J., includes, among other large orders, one for two 400-kw, 575-volt, engine-driven railway generators for the City of Edmonton, Montreal, Canada. The Michigan Alkali Company, Wyandotte, Mich., has placed an order for 95 hp in small motors with which to equip its plant. An order for eight rolling mill motors aggregating 170 hp has been placed by the Alliance Machine Company, Alliance, Ohio. A notable motor application will be that of the 125-hp 230-volt motor to operate a friction saw, which has just been ordered by the Pettibone Mulliken Company, Chicago, Ill. The Hanover Street Trust, Boston, Mass., is adding a small three-wire balancer to its equipment. This building already has about 100 kw of generating apparatus of Crocker-Wheeler make. A number of other orders have been received for direct and alternating current generators of various sizes and a large number of small motors.

GREGORY SALES.—Among recent shipments of the Gregory Electric Company are the following: 150-kw. Westinghouse railway generator to Keokuk Gas & Electric Company, Keokuk, Iowa.; 150-kw. Stanley three-phase, 60-cycle alternator to Stevens Point Power Company, Stevens Point, Wis.; 150-kw. three-phase 60-cycle Stanley alternator to Northern Light, Heat & Power Company, Wahpeton, N. D.; 150-hp. General Electric three-phase, 60-cycle motor, to Terre Haute, Indianapolis & Eastern Traction Co., Terre Haute, Ind.; 125-hp. General Electric three-phase motor to Muncie Electric Light Plant, Muncie, Indiana; 75-kw. Thomson-Ryan direct-connected 250-volt generator and Alfree engine to Knoxville Electric Company, Knoxville, Iowa; General Electric Type A S alternator and Chuse engine to city of McMinnville, Tenn.; 50-kw. Siemens-Halske generator and 165-hp. Ideal engine to Marion Brick Works, Marion, Ind.; 125-kw. Fort Wayne 250-volt generator to Blind River Light, Heat & Power Company, Blind River, Ont.; General Electric A S 120 alternator to Board of Public Affairs, Lebanon, Ohio; 50-kw. Northern 250-volt generator direct-connected to Ideal engine, to the Molitor-Hummel Realty Company, Milwaukee, Wis.; two 180-kw. General Electric A S 180 alternators to Danville Light, Heat & Power Company, Danville, Ind.; 30 kw. C & C 250-volt generator to R. E. Cobb, St. Paul, Minn.

MacGOVERN, ARCHER & CO., 114 Liberty Street, N. Y., report that they have made the following shipments within the past few weeks, covering generators, motors, etc., supplied to the various lighting and manufacturing companies: Direct-current generators wound for 125 volts have been shipped to the following companies: One 60-kw unit to Burley & Stevens, Newbury, Mass.; a 100-kw generator directly connected to an engine sent to H. M. Plimpton & Co., Norwood, Mass.; a 45-kw generator to the New England Machine & Electric Company, Pawtucket, R. I.; a 55-kw belted unit to John W. Potts, Little Falls, N. J.; a 60-kw generator to T. B. Rice & Sons Company, Philadelphia, Pa., and one 100-kw generator directly connected to an engine to Herbert F. Sawyer, Boston, Mass. Direct-current generators designed for 250 volts have been shipped as follows: A 160-kw belted generator and switchboard to the Commercial Coal Mining Company, Expedit, Pa.; one 65-kw belted unit to Bernard Rice's Sons Company, N. W.; one 100-kw unit and one 250-kw unit, complete with switchboards, to the Anglo-Canadian Leather Company, Canada; two 160-kw belted generators to Hatfield & Hilles, Philadelphia, Pa.; one 75-kw engine-driven generating set to Bawo & Dotter, New York, and one 400-kw Fort Wayne generator directly connected to a 600-hp Buckeye engine, complete with condenser and switchboard, to the Illinois Malleable Iron Company; a 225-kw 575-volt direct-coupled direct-current generating set has been shipped to the Blackwood Coal Company, Philadelphia, Pa., and one 85-kw 550-volt generator with switchboard, has been sent to the Ithaca Street Railway Company, Ithaca, N. Y. Three-phase alternators have been shipped to the following companies: One 100-kw unit, complete with switchboard, to the St. Johnsbury Electric Light Company, St. Johnsbury, Vt.; one 200-kw alternator to the Geneva Electric Light Company, Geneva, N. Y.; one 150-kw unit to the W. T. Adams Machine Company, Corinth, Miss.; one 75-kw belted alternator to the Keene Electric Railway Company, Keene, N. H.; two 200-kw alternators to the Middletown Lighting Company, Middletown, O.; one 200-kw belted alternator to the Columbia Light & Power Company, Columbia, Tenn., and one 200-kw belted alternator to the Gulf Lumber Company, New Orleans, La. The following two-phase alternators have been shipped: One 75-kw unit to the Augusta-Aiken Railway Company, Augusta, Ga.; one 180-kw belted alternator to the Nazareth Electric Light Company, Nazareth, Pa., and one 150-kw belted alternator, with switchboard, to the Georgetown Electric Company, Georgetown, S. C. The following belted alternators have also been shipped: One 125-cycle machine to the Mutual Light & Water Company, Brunswick, Ga.; one 60-kw unit to the Morse-Chain Company, Ithaca, N. Y.; one 120-kw alternator to the

American Gas & Electric Company, New York City; one 300-kw belted alternator to the La Porte Electric Company, La Porte, Ind., and one 180-kw belted alternator to the Greenville Electric Company, Greenville, Ohio. The following direct-current motors have been shipped: One 35-hp unit to T. B. Rice & Sons Company, Philadelphia, Pa.; one 215-hp 250-volt motor to the Atlantic Coast Lumber Corporation; four 250-volt motors to Paxton & Vierling, Omaha, Neb. Three-phase motors have been shipped to the following companies: Uxbridge & Northbridge Electric Company, Boston, Mass., one 150-kw machine; Texas Rolling Mills, Fort Worth, Texas, four motors; McCarthy Bros. & Ford, Buffalo, N. Y., one 75-hp 25-cycle motor; the International-Acheson Graphite Company, Niagara Falls, N. Y., one 75-hp three-phase motor; the Union Asbestos Mines, Canada, one 200-hp three-phase induction motor; the Hinckley Fibre Company, Hinckley, N. Y., one 150-kw three-phase motor, and the Ludlow Associates, Ludlow, Mass., three 150-hp 40-cycle motors. The company has also shipped a 150-hp engine to the Lancaster & Jefferson Electric Light Company, Lancaster, N. H., and has recently made a large number of sales of motors and smaller apparatus, which sales seem to indicate that manufacturers are finding it necessary to increase their motor equipments in order to fill the orders on hand.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York. Next meeting, Hot Springs, Va., May 17, 18, 19 and 20, 1909.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburg, Pa. Next meeting, June, 1909.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

American Street & Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Chicago & Illinois Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, S. E. Mumford, Detroit, Mich.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Chicago Electric Club. Secretary, S. M. McFedries, care J. L. Schureman & Co., Chicago.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and 32d St., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Next meeting, Des Moines, March 9, 10 and 11, 1909.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Minnesota Electrical Association. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn. Next meeting, Nicollet Hotel, Minneapolis, Minn., March 18 and 19, 1909.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

Missouri Electric Light, Gas & Street Railway Association. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, April 15, 16 and 17, 1909.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

Nebraska Electrical Association. Secretary, William Bradford, Lincoln, Neb.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y.

Northwest Electric Light & Power Association. Temporary chairman, J. D. Crary, Aberdeen, Wash. Next meeting, Seattle, 1909.

Northwestern Electrical Association. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio. Next meeting, Columbus, Ohio, March 18, 1909.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in March, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next meeting, New York, March 24 and 25, 1909.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 23, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

912,985. ELECTRIC HEATING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed June 8, 1907. The electric locomotive when hauling passenger cars supplies steam to the cars to heat them. The steam is generated by electric heaters carried by the locomotive.

912,994. ELECTRIC HEATING APPARATUS; F. Conrad, Swissvale, Pa. App. filed June 8, 1907. Steam is supplied by the electric locomotive when hauling passenger cars to heat them by means of a spiral coil carrying the water, the spiral at the same time carrying an electric current which heats the water.

912,995. ELECTRIC-MOTOR CONTROL SYSTEM; W. Cooper, Wilkinsburg, Pa. App. filed April 10, 1905. Means for cutting out one motor without interfering with the control of the remaining motors in a multiple train system. A plurality of independently actuated switches, one for each motor, is provided, together with means for preventing the operation of certain of the switches without interfering with the control of the circuits of the remaining motors.

913,016. ELECTRIC LAMP; Isador Ladoff, Schenectady, N. Y. App. filed Nov. 28, 1904. An open-mesh mantle of rare earth oxides surrounds the arc and is heated thereby.

913,017. DYNAMO-ELECTRIC MACHINE; B. G. Lamme, Pittsburg, Pa. App. filed Aug. 2, 1906. Prevents the magnetization of the fixed frames which support the coils of the armatures by providing a stationary ring-wound armature with non-magnetizable supports and a short-circuited secondary outside of the said ring winding.

913,024. CLAMP FOR ELECTRICAL AND OTHER FIXTURES; W. M. Meacham, Oak Park, Ill. App. filed Jan. 28, 1905. A clamp plate for electrically insulated bushings, having an aperture to receive the bushing, spring teeth forming part of the edge of the aperture and a rib surrounding the teeth.

913,041. FIRE PROTECTION SIGNAL SYSTEM; J. G. Nolen and J. E. Shepherd, Chicago, Ill. App. filed Mar. 20, 1905. A fluid containing receptacle is provided with a diaphragm which closes the opening of the receptacle; a local alarm circuit is controlled by an electric time switch, which in turn is controlled by a movable part within the receptacle.

913,045. SPARK PLUG; H. F. Parker, Montclair, N. J., assignor to Y. T. Frazee, Montclair, N. J. App. filed Dec. 1, 1906. A spark plug includes two terminals and a movable ball intermediate the two and normally in engagement with but one terminal. The ball moves about, decreasing the tendency for the deposit of soot or carbon.

913,052. ELECTRIC TIME-SWITCH; W. E. Richter, Albuquerque, N. M. App. filed Feb. 4, 1908. An automatic time-switch for electric light switches which can be set so as to cut out the circuit at any desired time. Details.

913,060. ELECTRICAL APPARATUS; O. Schaumberg, Pittsburg, Pa. App. filed June 8, 1907. The transformer casing, which radiates heat, is filled with fluid contained in a plurality of tubes located outside the body portion of the casing, which tubes connect with end enlargements of the casing. The oil or fluid circulates through the tubes.

913,080. RINGING KEY; Klas Weman, Buffalo, N. Y. App. filed July 10, 1907. Ringing key for telephone switchboards, having a slotted tube with a serrated edge, in which a plunger slides, the plunger having a pin engaging the slots and carrying a second pin having rollers resting in the serrations.

913,081. CONTACT FOR ELECTRIC CONTROLLERS OR SWITCHES; A. White, Sunderland, England. App. filed Sept. 10, 1908. A reversible and renewable contact secured to its carrier by a screw and having wings for contacting with the controller drum.

913,086. CIRCUIT-CONTROLLING INSTRUMENT; G. M. Willis, Chicago, Ill. App. filed May 17, 1907. For burglar alarms. A needle arranged between contact arms which closes the circuit when the burglar enters. Details.

913,104. UNDULATING-CURRENT APPARATUS; F. Cedergren, Hammond, Ind. App. filed Oct. 7, 1907. For producing intermittent, alternating and undulatory currents of different characteristics and different frequency. A commutator is mounted to oscillate by means of an oscillating armature, and means are provided for changing the amplitude of oscillation of the commutator.

913,105. ELECTRIC CURRENT INDICATOR; F. N. Conant, Newburyport, Mass. App. filed Jan. 11, 1907. An electric lamp is mechanically and electrically connected with the fuse so that if the fuse wire is disrupted the current passes through the lamp, giving the indication.

913,122. TROLLEY RETRIEVER; T. R. Gabel, Los Angeles, and A. L. Eacrett, Hollywood, Cal. App. filed Feb. 18, 1908. A retriever in which the trolley rope is wound on a reel and the pole pulled down when the trolley jumps the wire, the reel, during the downward movement, being locked against rotation. Details.

913,155. TROLLEY-WIRE CONNECTION; G. S. Pannebaker, Lewistown, Pa. App. filed Sept. 23, 1908. For uniting the severed ends of a trolley wire, by means of an elongated body portion having a groove to receive the wire and short grooves in which the ends of the wire are clamped.

913,160. ELECTRICAL CONNECTION; G. H. Pride, New York, N. Y. App. filed April 17, 1907. Makes use of two complementary insulated sections for the socket of a lamp, one fitting into the other. Details.

913,168. TROLLEY-WHEEL SHIELD; A. A. Roth, Buffalo, N. Y. App. filed Mar. 23, 1908. The shield throws the wheel out of contact with the switch contacts when passing them, thus preventing the trolley wheels of the trailers from affecting the switch and placing the latter wholly under the control of the leading car.

913,180. TEMPERATURE ANNUNCIATOR; N. D. Wyman, Montclair, N. J. App. filed May 14, 1907. An expansible liquid in a thermometer controls the circuit. A plurality of contact points are successively connected to the rising column of liquid. An arm is adjusted to any particular contact point so as to vary the point when the alarm rings.

913,183. TELEGRAPH TRANSMITTING MACHINE; J. C. J. Alderson, El Casco, Cal. App. filed Sept. 4, 1906. For sending messages at a high rate of speed by means of a vibrator forming one terminal of a circuit with a plate for regulating the vibration of the vibrator and a key to release the vibrator.

913,209. ARC LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed May 7, 1907. An electromagnet and armature are provided, the latter co-operating with one of the electrodes to permit them to separate to strike the arc, together with a retarding device and a lost motion connection between it and the armature, so as to retard the remainder of the movement of the electrode.

913,218. PROCESS OF RECLAIMING DEVULCANIZED RUBBER; E. E. Albert Georg Meyer, New Brunswick, N. J. App. filed April 29, 1908. Mixes devulcanized rubber with a resinous soap heats to above 120 deg. C., and during a portion of the treatment compresses the material.

913,240. ROLLER-BEARING TROLLEY; W. H. Sheasby, Los Angeles, Cal. App. filed Jan. 28, 1906. A pin is carried by the harp and an insulating tube surrounds the pin with a sleeve around the tube, rollers on the sleeve, a case around the rollers, insulating means around the case and a hub around the case insulating means, together with a wheel rim carried by the hub and a brush contacting therewith.

913,264. CABLE TERMINAL; F. B. Cook, Chicago, Ill. App. filed June 22, 1908. A cast box contains the terminal and is provided with a projecting end, which prevents rain or moisture from blowing through the passages through the end into the box. The box is divided into compartments for the aerial and cable conductors, respectively.

913,282. METHOD OF CONTROL FOR MOTOR SYSTEMS; E. Gruenfeldt, Cleveland, O. App. filed Jan. 23, 1908. Includes a series-wound motor in which the voltage is changed from a low to a high voltage. Reduces the amperage in the circuit as the voltage increases, breaking the low voltage connections before making the high voltage connections.

913,283. SYSTEM OF ELECTRICAL CONTROL FOR MOTOR VEHICLES; E. Gruenfeldt, Cleveland, O. App. filed Jan. 23, 1908. A series-wound motor, together with means for producing a low and high voltage, a controller and connections, the controller varying the connections so as to produce a high or low resistance circuit, including the motor, to change the circuit from low to high voltage

and to change from low resistance to high resistance prior to changing from low to high voltage.

913,308. ELECTRIC ARC LAMP; W. R. Ridings, Stretford, England. App. filed Feb. 20, 1904. Cuts out the coils which operate the striking and feeding mechanism of the lamp as soon as the arc is formed, the coils being cut in again by means of a shunt-wound magnet when the electrodes are required to feed.

913,309. ELECTRIC SIGN; B. E. Salisbury, Syracuse, N. Y. App. filed Sept. 16, 1907. An electric sign composed of two plates bolted together with a series of lamp receptacles of special construction clamped between the plates so that lamps may be inserted on opposite sides of the plates.

913,324. MANUFACTURE OF SILICON CARBID; F. J. Tone, Niagara Falls, N. Y. App. filed Feb. 13, 1907. The process of making dense silicon carbid, which consists in heating a porous mass of crystalline silicon carbid in proximity to commingled vapors of substances containing carbon and silicon to a temperature sufficient to cause the carbon and silicon to combine throughout the pores of the silicon carbid mass.

913,363. SYNCHRONIZING MEANS FOR ELECTRICAL APPARATUS; A. C. Crehore, Yonkers, N. Y. App. filed July 17, 1903. Provides means for sending special synchronizing electrical impulses over the line without interference with other transmission that may take place on the same or another line at the same time. Uses an alternating current for synchronizing, which is transmitted continuously over the line.

913,372. MEANS FOR SIGNALING OR EFFECTING OPERATIONS BY MEANS OF SOUND VIBRATIONS; John Gardner, Knott End, near Fleetwood, Eng. App. filed May 4, 1907. A submarine signaling system for use on ships in which a telephone transmitter is arranged in the hull with its diaphragm immersed in the water. Microphone contact are operated by the diaphragm to control a signaling instrument which is contained in a local circuit on the ship.

913,383. CIRCUIT CONTROLLER; S. Holland, Park River, N. D. App. filed Dec. 11, 1907. For multiple cylinder explosion engines, for varying the time of contact; makes use of a circular casing into which the contacts project radially and a shaft carrying a roller which rotates in the casing to make successive contacts. Details.

913,390. ELECTRODE FOR GAS ELEMENTS; E. W. Jungner, Kneippbaden, Norrkoping, Sweden. App. filed May 13, 1907. A galvanic gas element in which one of the electrodes is of carbon of such high porosity as to be incapable of retaining enough of the electrolyte to fill its pores.

913,415. METHOD OF OPERATING ALTERNATING-CURRENT MOTORS; R. D. Mershon, New York, N. Y. App. filed Jan. 25, 1904. Varies the speed of alternating current motorshaving different numbers of poles by changing the number of poles so that the motor with the new number of poles has an equal torque at the lower speed corresponding to the torque at the higher speed.

913,419. INSULATING TROLLEY-WIRE HANGER; L. W. Moran, Grafton, O. App. filed Feb. 7, 1908. A three-piece hanger having upper and lower metallic members with an insulating stem between them.

913,430. METHOD OF PRECIPITATING METALS ELECTROLYTICALLY; A. Ramen, Helsingborg, Sweden. App. filed Aug. 27, 1906. Electrolyzes a solution containing readily electrolyzible metals while maintaining a solution of ferous salts, substantially free of such metals, about the anode of the electrolytic cell. The latter solution acts as a depolarizer.

913,437. AUTOMATIC STARTER FOR CONTINUOUS-CURRENT ELECTROMOTORS; G. A. Schoeller, Mulheim-on-the-Ruhr, and Herman Sundhausen, Essen-on-the-Ruhr, Germany. App. filed March 12, 1907. A solenoid operated by a maximum current throws in a resistance in starting and another solenoid whose circuit is closed by the maximum solenoid cuts out the resistance.

913,439. DISK INSULATOR; Louis Steinberger, New York, N. Y. App. filed Nov. 27, 1905. Comprises a disk and a neck integral therewith, the disk and neck being both provided with corrugations so as to provide increased surface for surface leakage.

913,451. TELEPHONE EXCHANGE SYSTEM; G. Babcock, Rochester, N. Y. App. filed July 7, 1905. Prevents voice currents coming from the transmitter from being heard by the receiver at the substation. The cord circuit at the central exchange is divided into two inductively separated parts provided with repeating coils, which repeat the voice currents from one line to the other, and so arranged that the voice currents from either station pass differentially through the receiving coil and the repeating coils at the central exchange, and then serially through the line limbs of the other substation.

913,480. AUTOMATIC SWITCH AND STAND FOR PRESSING-IRONS; F. E. Emery, New York, N. Y. App. filed Mar. 27, 1908. A movable electric switch on the stand is operated by the sadiron to close the circuit, and an indicator shows whether the switch is opened or closed.

913,481. AUTOMATIC ELECTROMAGNETIC SWITCH AND STAND FOR PRESSING-IRONS; F. E. Emery, New York, N. Y. App. filed Aug. 24, 1908. An electromagnetically operated switch controls the electrical heating of the pressing-iron, and a signal indicator indicates whether the switch is open or closed.

913,493. ALARM DEVICE FOR GUN TURRETS; J. L. Hall, Schenectady, N. Y. App. filed May 20, 1908. Gives an alarm when the limit for permissible movement of the guns of one turret toward the other turret on the ship has been reached, so as to avoid the danger of the blast from one turret injuring those in the other turret.

913,512. STARTING DEVICE FOR ELECTRIC MOTOR; S. C. D. Knight, Schenectady, N. Y. App. filed Jan. 26, 1907. A starting rheostat with a spring returned arm and a no-voltage magnet for retaining it in running position, an automatic circuit breaker in circuit with the arm which opens the main circuit before the arm reaches the off position.

913,521. MULTIPLEX TELEPHONY; M. C. A. Latour, Paris, France. App. filed May 27, 1905. Superimposes on the positive half-waves of an alternating current a series of fluctuations from a telephone transmitter; superimposes on the negative half-waves the fluctuations of a second transmitter. Provides suitable means for separating the pulsations.

913,528. SIGNALING SYSTEM; R. H. Marriott, Brooklyn, N. Y. App. filed May 12, 1908. The combination of submarine bell wireless apparatus and telephone, the bell and telephone being located under water for locating positions of vessels in distress. The bell is located underneath the water at the sending end, and a telephone receiver is located underneath the water on the ship. A wireless transmitter sends signals. The operator on the ship receives the wireless signals and a little later the sound of the bell. By noting the difference in time between the signals and the sound, the distance between transmitter and receiver may be ascertained.

913,541. ELECTRIC MOTOR FOR HIGH-TENSION CURRENTS; N. Myschkin, New Alexandria, Russia. App. filed Oct. 30, 1908. An electrostatic motor without magnetic field consisting of a dielectric disk and a plurality of dischargers coacting therewith.

913,542. TROLLEY SAFETY DEVICE; H. Nannenhorn, Chicago, Ill. App. filed April 15, 1908. Automatically breaks the circuit through a severed section of trolley wire between the supports thereof so as to avoid danger to pedestrians. Details.

913,547. TURNBUCKLE FOR TROLLEY WIRES; H. Standwood Ollson, Mars, Pa. App. filed Oct. 10, 1908. For taking up slack in the wire without interrupting the passage of the trolley wheel upon the wire. Details.

913,557. BLOCK SIGNAL SYSTEM; G. S. Pflasterer, Nashville, Tenn. App. filed June 9, 1908. A block signal system for single track roads comprising an electrically controlled, manually operated signal with operating mechanism, including a slot circuit with means for preventing the energization of the circuit except when the track is free at one side of the signal and a portion of the track at the other side is occupied by a train.

913,562. BRUSH SPRING FOR DYNAMOS AND MOTORS; J. H. Poole, Washington, D. C. App. filed March 19, 1907. An antifriction roller is mounted at the free end of the brush spring, which forms the bearing surface for the spring, so as to permit high speed vibrations to take effect by lateral movements of the roller without transmitting any of said movement to the brush.

913,563. METHOD AND APPARATUS FOR REVIVIFYING DRY-CELL BATTERIES; H. B. Ramey, Alexandria, Va. App. filed June 30, 1908. Perforates the outer zinc casing of the battery and surrounds it with an absorbent material impregnated with an electrolyte.

913,566. ELECTRICAL FUSE SPITTER; J. B. Sauve and F. Bernardi, Mokelumne Hill, Cal. App. filed Feb. 19, 1908. Ignites the fuse by means of a circuit controlled by a push button, the fuse being provided with a tubular cap through which the wires pass that ignite it.

913,579. ELECTRIC BROILER; G. E. Stevens, Lynn, Mass. App. filed Oct. 16, 1907. A grid, together with an electrical heating unit of an elongated form in thermo relation with the grid.

913,584. CAM FOR LAMP-SOCKET KEYS; G. B. Thomas, Bridgeport, Conn. App. filed Dec. 18, 1907. The cam is cup-shaped and made of sheet metal of oblong form.

913,588. ADJUSTABLE COUPLING FOR ELECTRIC INSTALLATION TUBES; W. H. Vibber, New London, Conn. App. filed Jan. 2, 1909. A coupling sleeve having slots at the ends with yielding binding straps entering the slots which hold the tubes in the sleeve.

913,607. TELEPHONE CALL MECHANISM; W. E. Zabst, Portage, Wis. App. filed July 8, 1908. Telephone calls for party lines with means for preventing the operation of the signal bells of the not wanted subscribers. Provides a motor for operating the controlling device for the signals, together with a latch, which normally holds the motor and releases it when the party calls.

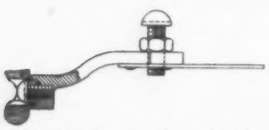
913,613. CALL-DISTRIBUTING TELEPHONE EXCHANGE DETAILS; S. H. Browne, Pittsburg, Pa. App. filed Aug. 3, 1905. A partly automatic, partly manual telephone exchange system comprising a line relay, a delay relay, a magnet which restores the exchange switch to a position of rest, and suitable circuits in which the parts are arranged. Details.

913,615. STREET CAR TROLLEY POLE WHEEL; S. Bryan, San Diego, Cal. App. filed June 20, 1907. A trolley pole with an arm pivoted thereto intermediate of its ends and adapted to swing laterally out of the line of the pole, together with a wheel mounted on the outer end of the arm.

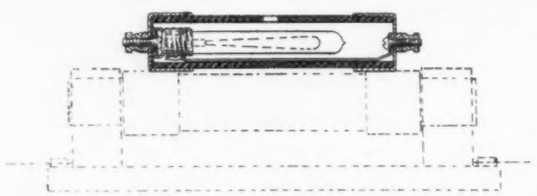
913,616. ELECTRIC METAL-WORKING APPARATUS; A. E. Buchenberg, Toledo, Ohio. App. filed June 25, 1908. Welds the ends of rings by providing in combination with the main work-clamping (or contact parts), auxiliary clamping parts which firmly grip the work and act to force the ends thereof together when any slipping occurs between the main clamping parts and the work.

913,666. DYNAMO-ELECTRIC MACHINE; L. Lyndon, East Orange, N. J. App. filed July 6, 1905. Carried by the axle of the car, and formed in separable sections, the rotor being secured to the axle and the stator inclosing the rotor and suspended from the truck pieces independently of the axle.

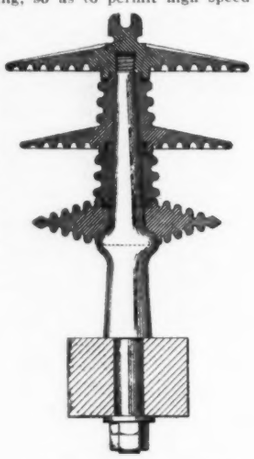
913,669. BURGLAR ALARM; C. G. Munsell, Sidney, Ia. App. filed Aug. 15, 1907. For doors and windows. A closed circuit is open by circuit breakers when the door or window is open. Details.



913,081—Contact for Electric Controllers or Switches.



913,105—Electric Current Indicator.



913,439—Disk Insulator.